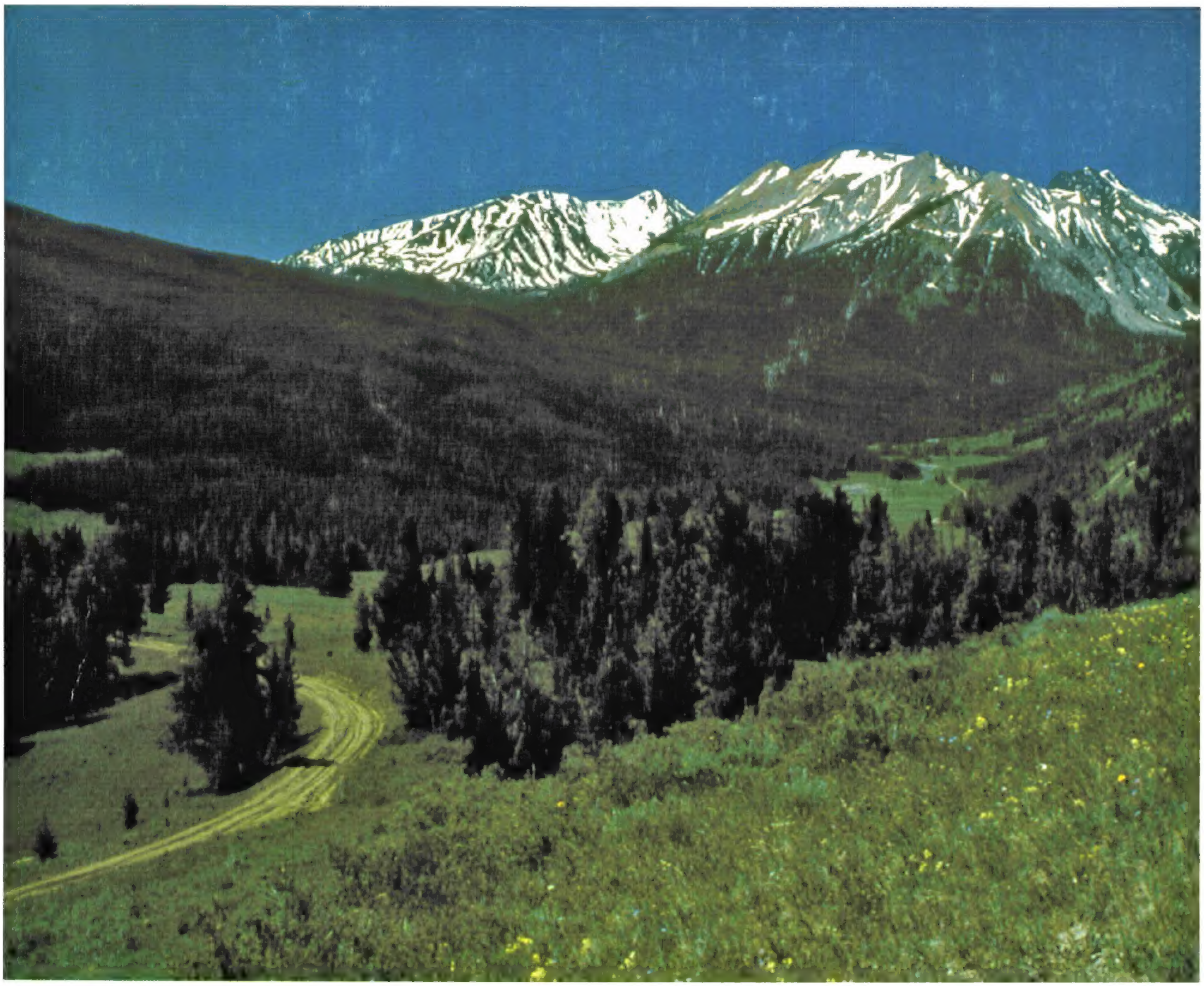
United States Department of Agriculture,
Natural Resources Conservation Service

In cooperation with the
Montana Agricultural Experiment Station

Soil Survey of Gallatin National Forest, Montana



How To Use This Soil Survey

General Soil Map

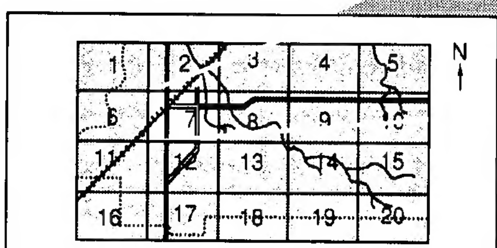
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

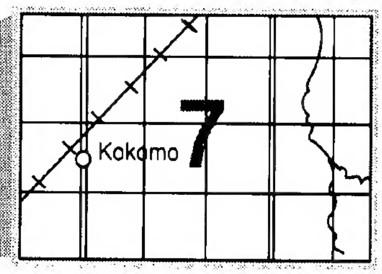
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



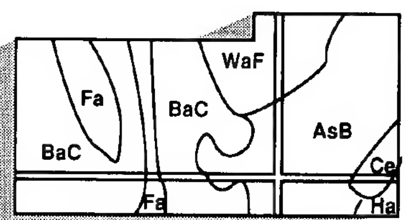
INDEX TO MAP SHEETS



MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.

MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The fieldwork, map unit design, and technical quality control for this survey were conducted by the Forest Service. The correlation of the soils was conducted by the Natural Resources Conservation Service (formerly the Soil Conservation Service) in consultation with the Forest Service. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Fieldwork for this soil survey was performed in the period 1976-80. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made by the Forest Service and the Natural Resources Conservation Service in cooperation with the Montana Agricultural Experiment Station.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Natural Resources Conservation Service and the Forest Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Typical landscape in the upper reaches of the Taylor Fork drainage area of Gallatin National Forest.

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Issued July 1996

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Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in the survey area. The landforms, natural vegetation, and bedrock were studied to a greater extent than usual in soil surveys in order to define and interpret map units. Surveys such as this one have been referred to in Forest Service publications as "land system inventories" or "integrated inventories." The map units have been called "landtypes."

This survey contains information that generally is not included in soil surveys. Examples are ratings of landslide potential and sediment delivery efficiency and limitations affecting road construction and maintenance. The survey is designed primarily for use by Forest Service personnel managing Gallatin National Forest. Others who are interested in management of Gallatin National Forest can use this information to more effectively participate in decisions affecting the environment of the forest.

The survey area includes some privately owned urban and agricultural lands. This survey was not designed to provide information to be used in planning uses of these lands. Additional information can be obtained from the local office of the Natural Resources Conservation Service.

Soil Survey of Gallatin National Forest, Montana

By Carl E. Davis and Henry F. Shovic

Fieldwork by Carl E. Davis, party leader; Clifford Montagne; Robert Ottersberg; Joni Sasich; Henry F. Shovic; Dean Sirucek; and Mark Stennard

United States Department of Agriculture, Forest Service and Natural Resources Conservation Service,
in cooperation with the
Montana Agricultural Experiment Station

The survey area is in southern Montana (fig. 1). It is directly north of Yellowstone National Park and includes parts of Gallatin, Madison, Meagher, Park, and Sweetgrass Counties.

The total area in this survey is 1,504,068 acres. About 73 percent of the area is National forest. Most of the private land within the survey area is land that was given to railroads through land grants during the 19th century. This land forms a checkerboard pattern with the National forest.

The survey area is mountainous with very narrow valleys along the major streams. Elevation in the survey area ranges from about 5,000 feet near Bozeman to 11,316 feet at Hilgard Peak in the Madison Range. The average annual precipitation ranges from 13 inches in intermountain valleys to 80 inches near Cooke City, which is in the Absaroka Range. The survey area is mainly coniferous forest. Mountain grassland and shrubland are at lower elevations and on mountain slopes that have a southerly aspect, and alpine meadows are on mountain ridges at higher elevations.

The land in the survey area mainly is used for recreation, livestock grazing, timber production, watershed, and wildlife habitat. Many unpatented mining claims, inactive mines, and undeveloped oil and gas leases could result in additional land uses in the county.

General Nature of the Survey Area

This section provides general information about the survey area. It describes physiography and drainage, geology, climate, and vegetation.

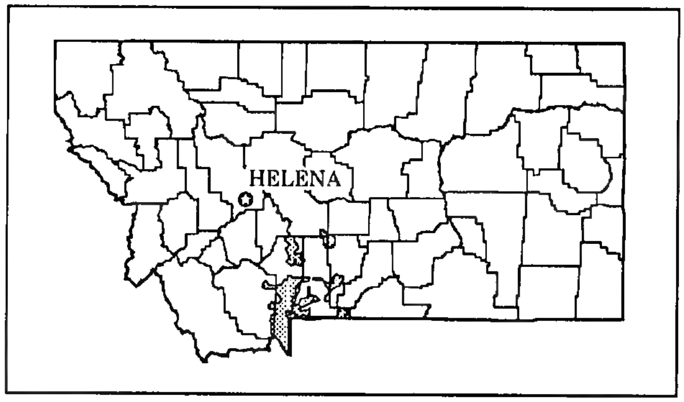

Figure 1.—Location of the survey area in Montana.

Physiography and Drainage

The survey area lies within the Northern and Middle Rocky Mountain physiographic provinces. The Yellowstone River valley forms the boundary between these provinces. The survey area includes seven distinct mountain ranges—the Beartooth, Absaroka, Crazy, Bridger, Gallatin, Madison, and Henry's Lake Ranges. It is drained by five major rivers—the Yellowstone, Boulder, Shields, Gallatin, and Madison Rivers (fig. 2). Each mountain range has distinctive features. The Absaroka and Beartooth Ranges are steep and rocky. They commonly include U-shaped glacial valleys, glaciated peaks, and high plateaus. The

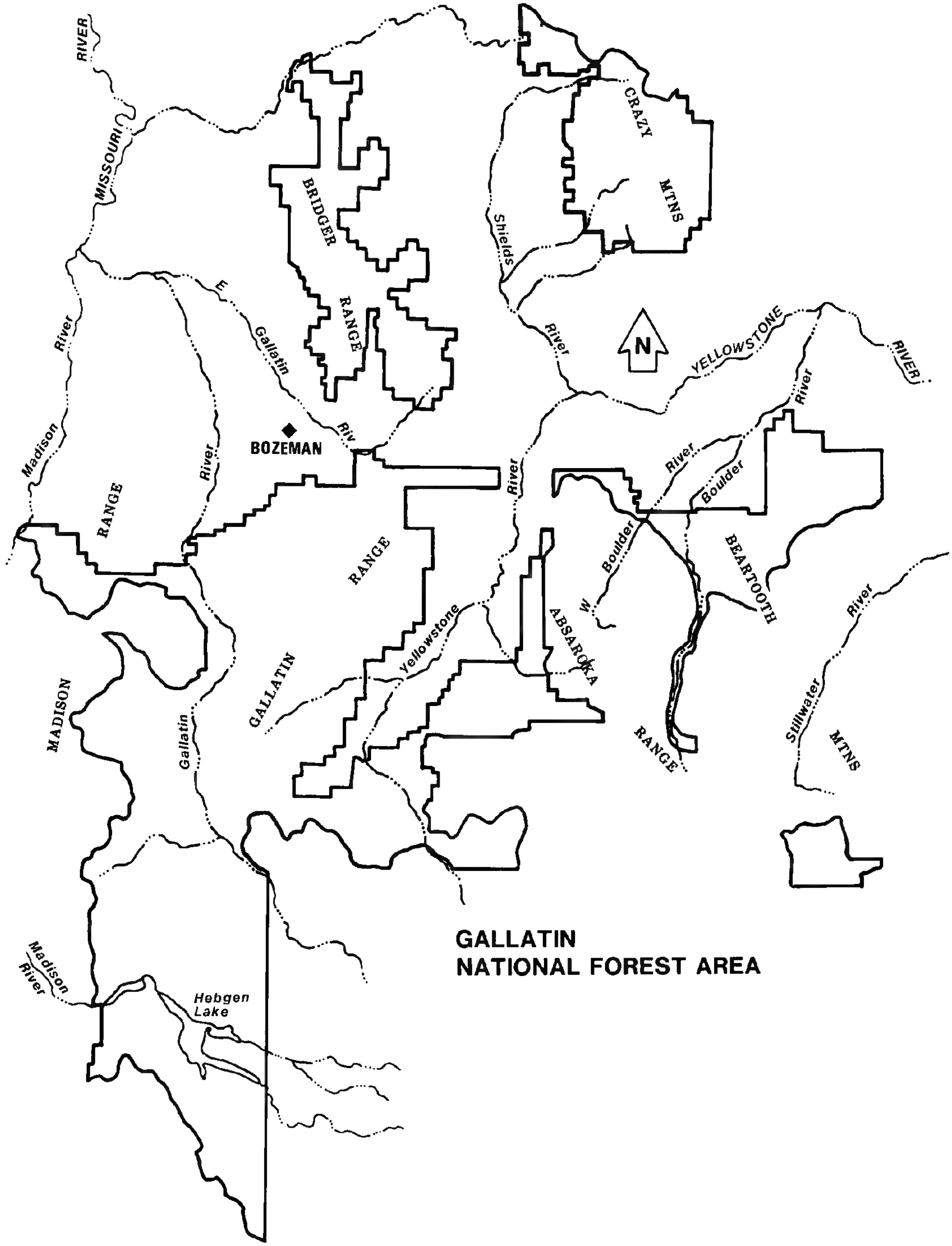

Figure 2.—Physiographic features of the survey area.

Crazy Mountains have a central core of steep, glaciated land but are surrounded by benches, ridges, and outwash plains, all of which have low relief. The Bridger Range is a long, narrow limestone ridge flanked by rolling foothills. The Gallatin and Madison Ranges contain ridges, steep stream-cut and glacial valleys, and broad, sloping benches. In the Henry's Lake Range, high plateaus dominate the southern and eastern parts of the range and steep glaciated landforms and outwash plains are in the northern and western parts.

The Yellowstone River flows northeast from Yellowstone National Park. It follows a large, gently sloping valley between the Absaroka and Gallatin Ranges. The Boulder River flows northward from the Absaroka and Beartooth Ranges. Three other major rivers dissect the survey area. They flow in deep, U-shaped valleys. The Shields River originates in the western part of the Crazy Mountains and flows south into the Yellowstone River, near the town of Livingston. The Gallatin River, which originates in Yellowstone National Park and flows northward, divides the Gallatin and Madison Ranges. The Madison River originates in Yellowstone National Park and flows west through Henry's Lake Mountains, near the town of West Yellowstone. Hebgen Lake is a large reservoir formed by a dam on the Madison River.

Landforms

The landforms in the survey area have been influenced by erosion and deposition by water and glaciers. Much of the survey area has been glaciated by alpine glaciers. Common glacial landforms include U-shaped valleys, cirques, outwash terraces, and rolling glacial moraines. In some areas the action of streams has produced V-shaped valleys, terraces, and flood plains.

The shape of many landforms is controlled by the structure of the bedrock. The bedding and hardness of the bedrock and the orientation of the beds affect the location of stream channels and the gradient and shape of slopes. Relatively recent deposits of lava retain their flowlike appearance in some areas. Landslides commonly are in areas where some of the layers of bedrock are soft. The areas of material deposited by landslides can be large and irregular in shape.

Each detailed soil map unit in this survey is on a characteristic landform. Slope, the shape of the slope, the pattern and density of low-order streams, relief, and other properties are used to define landforms. A strong relationship between the properties of landforms and the properties of soils and vegetation is common. The pattern of landforms visible on aerial photography was used to plot the boundaries of the map units. The properties of the landforms were used to interpret sediment delivery efficiency and the potential for landslides for the map units. They were important in evaluating the difficulty and cost of road construction. They can help map users identify map unit delineations.

The following classes of landforms were used to define map units and assist in mapping.

Mountain ridges are gently rounded, convex ridgetops that have poorly defined drainage channels 750 to 5,000 feet apart. The distance between the drainage channels is greatest on alpine ridges. The soils are weakly developed and formed in material containing many angular or subangular rock fragments. Frost action has mixed the rock fragments and the soil together and has probably been most responsible for shaping the mountain ridges. Patterned ground is at the highest elevations.

Glaciated mountain ridges are broad, undulating or rolling glaciated ridges. The dominant slopes have gradients of 5 to 20 percent (fig. 3). Thin deposits of glacial drift are in depressions and along drainageways. The soils on knolls formed in material weathered from the underlying bedrock. The drainage pattern is poorly defined. Drainageways are 750 to 5,000 feet apart. The distance between major changes in the aspect of the slopes is more than several thousand feet.

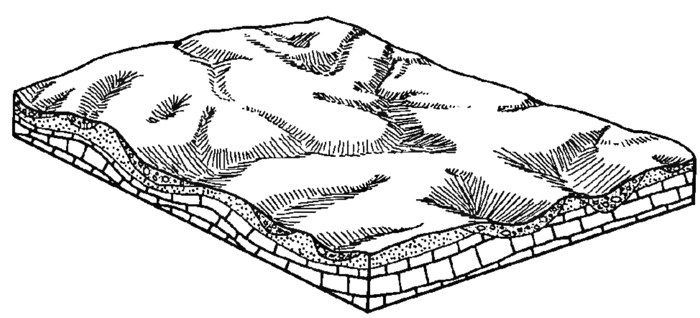

Figure 3.—A glaciated mountain ridge.

Glacial cirque headwalls and *trough walls* were formed by glacial erosion (fig. 4). They are usually at the higher elevations and have very steep, concave slopes. The slopes are dissected by well defined, intermittent streams 250 to 500 feet apart. The drainage system has a parallel pattern and steep channel gradients. The distance between major changes in the aspect of the slopes is 800 to 2,000 feet. Areas of rock outcrop are common. Associated landforms are cirque basins and moraines.

Glacial cirque basins are characterized by low relief and were formed by glacial overriding with a combination of scouring and deposition of drift (fig. 4). These basins are found at the head of glacial valleys. They are semicircular and contain scoured, striated outcrops of bedrock and thin, discontinuous deposits of glacial drift. They are dissected by poorly defined perennial and intermittent streams 1,000 to 2,500 feet apart. The distance between major changes in the aspect of the slopes is more than 2,000 feet.

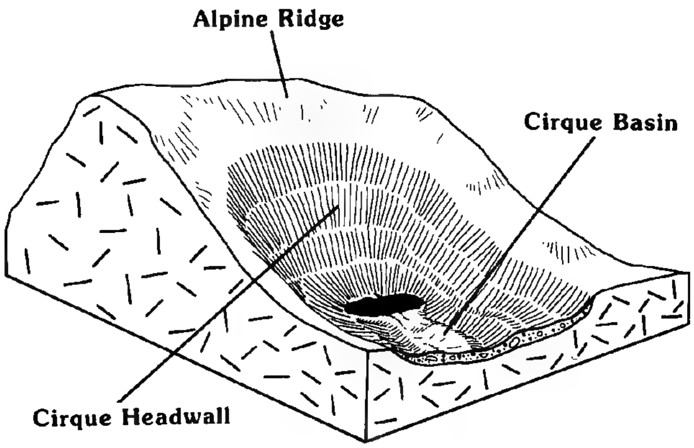

Figure 4.—Glacial cirques have very steep headwalls and basins, which often contain small lakes.

Moraines are hummocky or hilly glacial drift deposits (fig. 5). They can be end, ground, or lateral moraines. They can be found in nearly all topographic positions in glaciated areas. The moraines are dissected by well defined, large perennial streams. The drainage system is low order and has a deranged pattern. Many undrained depressions are in the moraines. The distance between major changes in the aspect of the slopes is 800 to 2,000 feet.

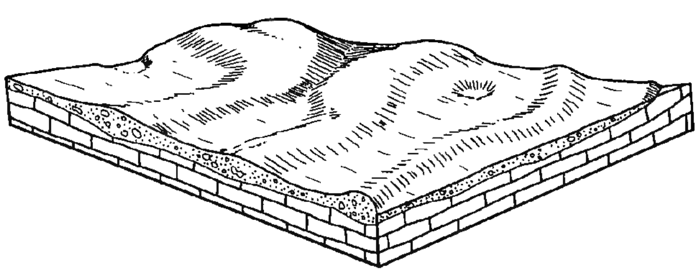

Figure 5.—A hummocky and hilly moraine.

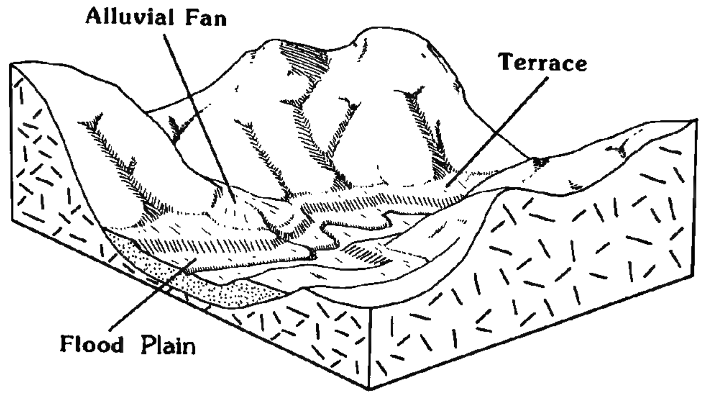

Figure 6.—Terraces, alluvial fans, and flood plains are on stream bottoms.

Terraces are formed by glacial outwash or alluvial deposits (fig. 6). They are associated with glaciated areas, either within glacial valleys or below them. Terraces have a smooth linear appearance and braided stream channels and are characterized by low relief. They are dissected by poorly defined, intermittent streams 500 to 5,000 feet apart. The drainage system has an irregular pattern and low channel gradients. Terraces have no major changes in slope aspect.

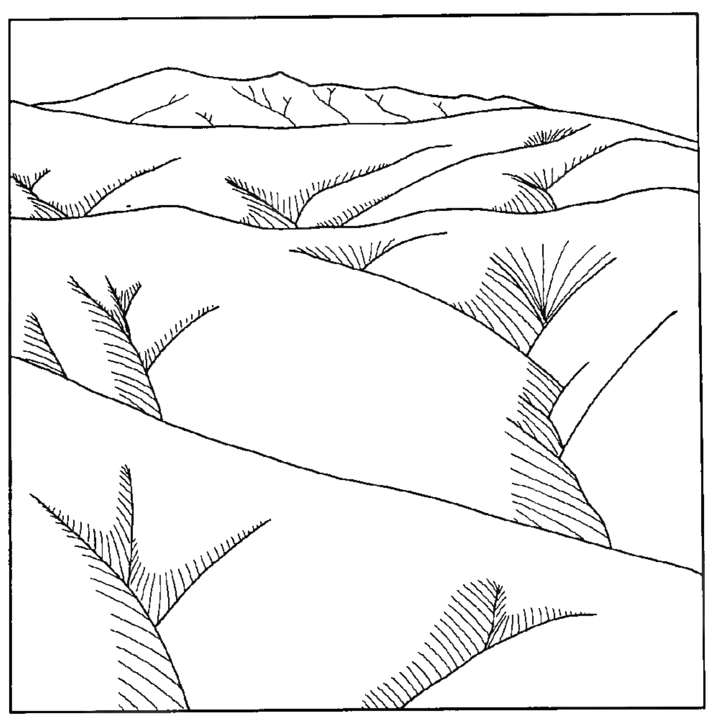

Figure 7.—A mountain slope.

Mountain slopes have convex upper slopes and ridgetops and straight lower slopes (fig. 7). They are in well defined, V-shaped valleys that are dissected by drainageways 350 to 1,000 feet apart. The drainage system has a parallel or nearly parallel pattern and moderate to steep channel gradients. The distance between major changes in aspect of the slopes is less than 800 feet on moderately steep slopes and 800 to 2,000 feet on steep slopes.

Glaciated mountain slopes are mountain slopes that are mantled with glacial drift (fig. 8). They are the lower slopes of U-shaped glacial valleys. They are in well defined valleys that are dissected by drainageways 500 to 2,500 feet apart. The distance between major changes in aspect of the slopes is 800 to 2,000 feet. Narrow glacial valley bottoms containing flood plains, terraces, and alluvial fans are included in mapping.

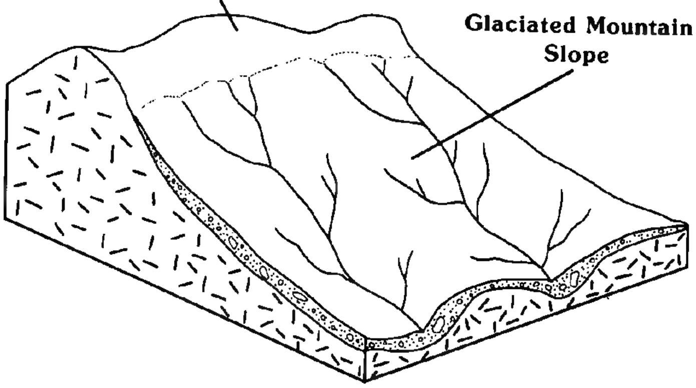

Figure 8.—A glaciated mountain slope.

Alluvial fans are formed by stream deposition in areas where channel gradients rapidly decrease. They are in areas where a stream emerges from a narrow mountain valley onto a broader valley bottom or plain (fig. 6). They are smooth, convex, fan-shaped deposits. Their apex is at the mouth of the stream. Alluvial fans are dissected by poorly defined, intermittent streams 1,000 to 5,000 feet apart. The drainage system has braided channels with moderate gradients. Alluvial fans have no major changes in slope aspect.

Flood plains are along the major streams (fig. 6). They generally contain one major perennial stream with low channel gradients. They occasionally contain a dry stream channel. Tributary streams enter the main stream at 1,000 to 5,000 feet intervals. Flood plains have no major changes in slope aspect.

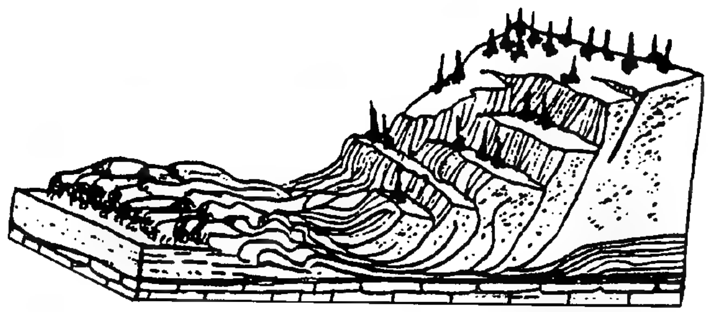

Figure 9.—Topography in an area of a landslide.

Landslides are produced by massive, relatively rapid downslope movement of material (fig. 9). The displaced material is derived from interbedded sandstone and shale, volcanic rocks, or glacial drift weathered from these rocks. Landslides include slump escarpments, tension cracks, and hummocky topography. They do not have an internal drainage system. They have ponds in depressions. Landslides are dissected by poorly defined, intermittent or perennial streams 500 to 1,000 feet apart. The drainage system has a deranged or irregular pattern. Streambanks are nearly vertical in areas where channels are well defined. The distance between major changes in aspect of the slopes is less than 800 feet.

Colluvial fans are at the base of steep slopes and cliffs. They have concave or nearly straight slopes composed of rock fragments and soil material. They are dissected by poorly defined, intermittent streams 2,500 to more than 5,000 feet apart. The drainage system has a parallel pattern and steep channel gradients. Colluvial fans have no major changes in slope aspect.

Structurally controlled slopes have shapes controlled by geologic structure (fig. 10). They formed on sedimentary rock. Landforms underlain by thinly bedded sandstone and shale have parallel ridges that are underlain by sandstone and intervening valleys that are underlain by shale. Landforms underlain by thickly bedded sandstone or limestone with thin beds of shale have smooth slopes parallel to the dip of the underlying limestone or sandstone layers with benches or swales that are underlain by shale. The landforms that are underlain by thinly bedded sandstone and shale are dissected by well defined drainageways 500 to 1,000 feet apart. The drainage system has a trellis, dendritic, or parallel pattern. The landforms in shallow valleys that are underlain by thick limestone or sandstone beds have parallel drainageways 500 to 2,500 feet apart. The

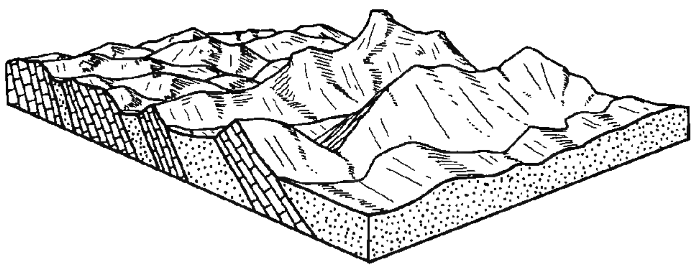

Figure 10.—A structurally controlled slope having parallel ridges underlain by sandstone and intervening valleys underlain by shale.

distance between major changes in aspect of the slopes is more than 2,000 feet on slopes underlain by thickly bedded limestone or sandstone and 800 to 2,000 feet on landforms underlain by thinly bedded sandstone and shale.

Lava flows are plateaus that are several hundred feet above the surrounding landscape (fig. 11). They are often lobate in outline. They are dissected by well defined, intermittent drainageways 1,000 to 5,000 feet apart. The drainage system has a dendritic pattern and low or moderate channel gradients. Lava flows have no major changes in slope aspect.

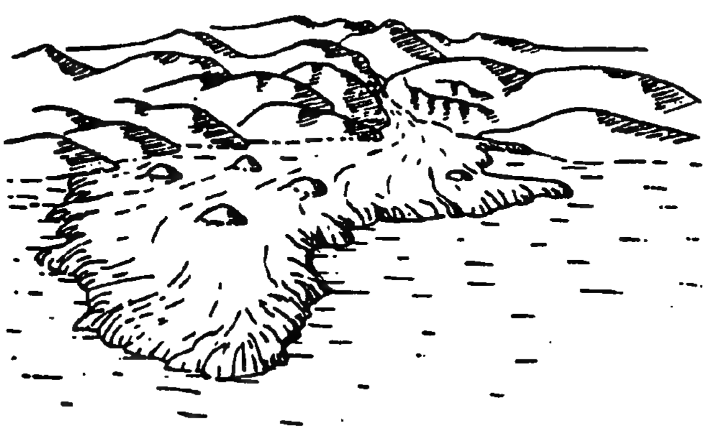

Figure 11.—Lava flows are lobate plateaus formed by solidified lava.

Geology

The mountain ranges in the survey area have a core of granitic rock that is partially covered by folded and faulted sedimentary beds. Sandstone, shale, and limestone are the common sedimentary rocks. Extensive volcanism occurred during the Cretaceous and early Tertiary periods *(18)*. Many eruptive centers have been located in the Absaroka Range and in the southern part of the Gallatin Range. Volcanic rocks were deposited over older granitic and sedimentary rocks. The Absaroka volcanics are major extrusive volcanic rocks. They are nearly flat andesite and breccias. Deposits are as thick as 4,000 feet *(5)*.

There are many relationships among geology, soil, and landforms in the survey area. The physical and chemical properties of soils and the underlying material are often directly related to the kind of bedrock or to the geologic origin of the material. When relationships between soil properties and geology were observed, geology maps were used to help map the distribution of soils. Relationships between geology and the performance of soil substrata along road cutbanks, in roadfill, and as native road surface were observed. The interpretations for these uses are based on these relationships. Geology also is an important factor used in interpreting the potential for landslides in the map units.

The following geologic groups were defined to assist in mapping and interpreting map units. The groups include geologic materials that have similar soil and landform properties.

Granitic rocks.—This group comprises medium and coarse grained igneous and metamorphic rocks, mostly from the Precambrian period. Igneous, intrusive rock of Tertiary age is included in this group. The major kinds of rock are granite, diorite, schist, gneiss, and partially metamorphosed sedimentary rock. All of these rocks contain relatively high amounts of quartz and feldspar and some iron- and magnesium-rich minerals.

This geologic group forms the core, or basement rock, of many mountain ranges in the survey area *(12)*. Extensive areas of granitic rocks are found in the Crazy Mountain Range, in the northern part of the Madison and the Absaroka-Beartooth Ranges, in the southern part of the Absaroka-Beartooth Range, and in the northwestern part of the Bridger Range *(4, 8, 16, 18)*. These rocks tend to underlie landforms that are characterized by high relief. About 50 to 100 percent of the upper layer of bedrock is hard and difficult to excavate.

The soils in this geologic group are coarse or moderately coarse in texture and are acid.

Rhyolitic rocks.—This group comprises volcanic rocks that are rich in quartz and vitrified volcanic ash. Rhyolite lava flows and ash in the survey area originated mainly from volcanic sources in Yellowstone National Park during the early Quaternary period. Deposits in the survey area are north and south of the town of West Yellowstone. About 10 to 50 percent of the upper layer

of bedrock is hard and difficult to excavate.

The soils in this geologic group are medium textured and acid.

Volcanic rocks.—This group comprises fine grained, extrusive igneous rocks that were ejected from volcanoes as lava or pyroclastic flows. The major kinds of rock in this group are welded tuffs, andesite, basalt, and volcanic breccias *(12)*. They are nearly flat andesite and breccias.

These rocks are in the northern and eastern parts of the Gallatin Range and the southern part of the Absaroka-Beartooth Range. Basalt flows are in the Yellowstone River valley. About 10 to 50 percent of the upper layer of bedrock is hard and difficult to excavate.

The soils in this geologic group tend to be more basic in reaction than soils associated with rhyolite flows and are finer textured than those associated with granitic rock or obsidian sand.

Sandstone.—This group comprises thick beds of sandstone interbedded with thin beds of claystone and siltstone. It includes the Livingston Group as defined by Roberts *(18)* and the Fort Union Formation. It is on the eastern flank of the Bridger Range, in the foothills surrounding the Crazy Mountains, and on the foot slopes in the northeastern part of the Absaroka-Beartooth Range.

This group is mainly made up of competent rocks that underlie relatively stable landforms. It is associated with soils having a substratum that is resistant to erosion. Less than 10 percent of the upper layer of bedrock is hard and difficult to excavate.

Interbedded sandstone and shale.—This group comprises alternating beds of relatively hard sandstone and softer shale. The geologic formations in this group are from the time frame that encompassed the Cambrian period through the Tertiary period. This geologic group is throughout the survey area but is most common in the eastern part of the Madison Range, the northern part of the Absaroka-Beartooth Range, the Bridger Range, and the northern part of the Gallatin Range.

This group is associated with landforms that are subject to landslides. The shale is associated with soils that contain more clay and are relatively less permeable than those associated with sandstone. About 10 to 50 percent of the sandstone beds are hard and difficult to excavate.

Limestone.—This group comprises thick beds of limestone or dolomite with thin beds of calcareous sandstone or shale. These rocks are found in many geologic formations, but the thickest beds are from the Mississippian and Cambrian periods *(13)*. This geologic group is in the northwestern part of the Gallatin Range and the northern and eastern parts of the Absaroka and Beartooth Ranges. It also forms the ridge line of the Bridger Range.

The rocks in this group weather slowly and tend to form landforms that are characterized by high relief and that include rock outcrops. Medium textured, moderately alkaline, base-saturated soils are associated with this geologic group. About 50 to 100 percent of the upper layer of bedrock is hard and difficult to excavate.

Glacial drift.—This group comprises glacial till and outwash. The deposits are generally from the Quaternary period. They are in small areas throughout the survey area.

Medium textured and moderately coarse textured soils are associated with glacial drift derived from granitic rocks and sandstone. Medium textured and moderately fine textured soils are associated with drift derived from interbedded sandstone and shale or volcanic rocks. Bedrock is rarely encountered during excavation.

Obsidian sand.—This group comprises glacial outwash and alluvial deposits derived from obsidian and rhyolite *(8)*. It is in the West Yellowstone River basin.

The soils that formed in this material are coarse textured, acid, and droughty. Bedrock is rarely encountered during excavation.

Climate

The survey area has a continental climate. Temperatures vary widely on a daily and seasonal basis with recorded air temperatures ranging from -60 to 104 degrees F *(20)*. Average annual precipitation ranges from 13 inches in intermountain valleys to more than 80 inches in alpine areas.

The majority of precipitation is received from Pacific air masses, with some additional moisture from arctic and gulf coast air masses. The arctic air masses often interrupt normal airflow and produce below zero temperatures during winter. The local climate in the mountains is highly variable, depending on slope, aspect, elevation, and the rain shadow effects produced by the mountains. South-facing, grassy slopes can have little snow cover and relatively warm average temperatures. Windswept ridges can be extremely cold and have little snow cover. Snow on north-facing slopes in the higher elevations can persist well into early summer. Frost pockets are in low areas where cold air accumulates at night during summer.

In winter, the temperature is relatively cold and most precipitation falls as snow. The average temperature for the period November through February is 23 degrees F. In the Yellowstone River valley and around Big Timber, occasional warming winds, or chinooks, occur. These winds rapidly raise the air temperature

and reduce the snowpack through evaporation.

Spring is dominantly cool and wet. Precipitation is highest in late May and early June. Snowstorms can occur at any time at the higher elevations.

Summer is warm and relatively dry. The average temperature during the period June through August is 60 degrees F. Cloudy days are infrequent. High intensity thunderstorms of short duration occur frequently throughout the summer. They generally occur in the Crazy Mountains and the northern part of the Absaroka Range. Several inches of snow can fall in June and August.

Autumn is dry and cool. The first snow falls in September; however, autumn weather can last until December. Soils not covered by snow are generally frozen by late October.

The average relative humidity generally is low. The average frost-free season ranges from about 130 days in the valleys to less than 30 days in alpine areas *(3)*.

Vegetation

The vegetation in the survey area is predominantly coniferous forest with extensive, scattered areas of grassland, shrubland, and meadows throughout the forest. Lodgepole pine, Douglas-fir, Engelmann spruce, limber pine, ponderosa pine, whitebark pine, and subalpine fir are important tree species. Big sagebrush, Idaho fescue, bluebunch wheatgrass, mountain brome, junegrass, and western needlegrass are common species in areas of grassland and shrubland and in meadows. The plant communities often reflect the occurrence of periodic wildfires. Slope, aspect, and elevation also are important factors affecting the distribution of plant communities.

Habitat Types

Habitat types are considered to be basic ecologic subdivisions of landscapes. Each is recognized by distinctive combinations of overstory and understory plant species at climax. They are named for the dominant or characteristic vegetation of the climax community.

Habitat types are particularly useful in soil surveys of mountainous areas for assessing the combined effects of aspect, slope, elevation, and soil properties on potential plant growth. The distribution of habitat types within map units was an important factor in evaluating potential timber and forage productivity, limitations to forest regeneration, and wildlife habitat potential in this survey. Forest habitat types are defined "Forest Habitat Types of Montana" *(17)*, and grassland and shrubland habitat types are defined in "Grassland and Shrubland Habitat Types of Western Montana" *(14)*.

Habitat types often have similar implications for the kind of interpretive uses made of them in soil surveys. Habitat types with similar management implications are grouped in this report. Group names are used throughout the report. The groups are described in the following paragraphs.

Mountain grassland and *mountain shrubland*.—These habitat type groups are in warm, relatively dry areas. They generally are at the lower elevations but are on south- and west-facing slopes up to an elevation of 9,100 feet. Big sagebrush/Idaho fescue is the most common shrubland habitat type. Idaho fescue/bluebunch wheatgrass is the most common grassland habitat type. The production of livestock forage is low or moderate.

Mountain meadows.—This habitat type group is at elevations of 6,500 to 8,600 feet. It is in scattered areas of dense lodgepole pine forest and dense Douglas-fir forest. On well drained soils, the most common habitat type is Idaho fescue/bearded wheatgrass. On poorly drained or somewhat poorly drained soils, the most common habitat type is tufted hairgrass/sedge. The potential for livestock forage production is high.

Alpine meadows.—This habitat type group is at elevations of more than 8,700 feet. It is generally associated with the timberline forest habitat type group. Idaho fescue/tufted hairgrass is an extensive habitat type within the alpine meadows group. Alpine meadow communities commonly include alpine timothy, sedges, and numerous forbs. The potential for livestock forage production is low, and the grazing season is short.

Open-grown forest.—This habitat type group is in warm, dry areas at the lower elevations. The understory is dominated by bunchgrass or bunchgrass and drought-resistant shrubs. The overstory forms an open canopied forest. The dry climate limits stocking. Douglas-fir/Idaho fescue is a common habitat type in this group. Limber pine and ponderosa pine habitat types are also included. The limber pine habitat types are at elevations of 5,800 to 7,700 feet in the Bridger Range, the Boulder River area, and the Deer Creek area. Timber productivity is low; however, understory forage production is higher in this habitat type group than in other groups.

Dense lodgepole pine forest and *dense Douglas-fir forest*.—These habitat type groups are in warm, relatively moist areas at elevations of 5,500 to 7,200 feet. Douglas-fir and lodgepole pine habitat types are in these groups. The understory is dominated by shrubs and forbs. The Douglas-fir/snowberry habitat type is extensive, especially on soils formed in material derived from limestone. The lodgepole pine/bitterbrush habitat type is extensive near West Yellowstone on sandy soils formed in material containing obsidian sand.

Timber productivity is moderate or high.

Lower subalpine forest.—This habitat type group is in cool, relatively moist areas at elevations of 7,200 to 8,200 feet. Engelmann spruce habitat types and the subalpine fir habitat types that grow at the lower elevations are in this group. Subalpine fir/pinegrass and similar habitat types are common in the driest areas. Subalpine fir/grouse whortleberry and similar habitat types are in the slightly moister areas at the higher elevations. They grow best in areas where the soils are moderately coarse textured. They are the most extensive habitat types in this group. Subalpine fir/twinflower and similar habitat types are on the moist, north-facing slopes at the mid and lower elevations. Subalpine fir/sweetscented bedstraw and similar habitat types are common in wet areas around seeps and in narrow drainageways. These habitat types generally are in the dense lodgepole pine forests. Timber productivity is moderate or high.

Upper subalpine forest.—This habitat type group is in cold areas at elevations of 8,200 to 8,700 feet. The subalpine fir/whitebark pine/grouse whortleberry habitat type is in this group. Timber production is very low to moderate. Forest regeneration is limited by the harsh climate.

Timberline forest.—This habitat type group is at elevations of 8,700 to 9,000 feet. Whitebark pine/subalpine fir and other whitebark pine habitat types are in this group. The climate is harsh and is characterized by short growing seasons, strong winds, intense solar radiation, and cool temperatures. Trees are stunted and sometimes are deformed by the wind. The potential for timber production is very low.

Riparian.—This habitat type group is a minor community type that is along streams. The overstory generally is deciduous trees or shrubs. The understory is made up of plants that can tolerate the wetness. No habitat types are defined for this group.

How This Survey Was Made

The survey area is mountainous and heavily forested. Mapping techniques used in other survey areas were impractical because access in the area is difficult. The mapping techniques used relied heavily on plotting map unit boundaries using features visible on aerial photography. Most commonly, these features were landforms or natural vegetation. Also, geologic maps were studied and the elevation of the site was considered when the map unit boundaries were plotted. Observations were made along field transects and traverses through representative delineations of the map units. Relationships between properties important to survey objectives and features visible on aerial photography were observed. Sometimes different features were used to plot map unit boundaries as a result of field checking. Reliable relationships between photographic features and map unit properties were established. These properties were observed and described in the field. The number of delineations of each map unit observed in the field varies. Generally, those map units with the most reliable association of properties to photographic features were observed the least. Physical and chemical properties of soils that cannot be measured with field techniques were derived from laboratory characterization of soils within the survey area and similar soils in adjacent areas.

Table 1 lists the most important features used to plot the boundaries of the map units. Landform, slope, parent material, vegetation, aspect, elevation, and rock outcrop are described under the headings "Physiography and Drainage," "Geology," and "Vegetation." The map units in this survey are described under the headings "General Soil Map Units" and "Detailed Soil Map Units."

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have similar parent material, topography, soil patterns, and climate. Typically, a map unit consists of one or more major soils and some minor soils.

The general soil map can be used to compare the suitability of large areas for common land uses. The map is not suitable for planning the use of small areas because of its small scale.

Soils at Low Elevations on Mountain Slopes and in Valleys

These soils formed under mountain grassland, mountain shrubland, and the associated open-grown forest. They generally are at elevations of 6,200 to 7,000 feet. They are mainly used for livestock grazing, as range for wildlife in winter, and for recreational activities.

1. Soils on flood plains, terraces, and alluvial fans

This map unit is on nearly level to sloping flood plains, terraces, and alluvial fans adjacent to major streams. The soils formed in alluvium or glacial outwash.

This map unit makes up about 2 percent of the survey area. It is about 50 percent Borolls, 30 percent Boralfs, and 20 percent Aquolls and Aquepts.

The Borolls are in grassland or shrubland and have a thick, dark surface layer. Typic Cryoborolls and Argic Cryoborolls are common. The Boralfs are forested and have a thin, dark or light colored surface layer. Typic Cryoboralfs are common. The Aquolls and Aquepts are vegetated with riparian plant communities and have a fluctuating water table. In places they are occasionally flooded.

The forage production of the grassland and shrubland is moderate or high. Timber productivity is low in the forested area. The major streams provide good habitat for fish and opportunities for fishing and camping. The riparian vegetation provides good habitat for a wide variety of wildlife, particularly moose. The vegetation on streambanks and in wet areas is susceptible to trampling damage by livestock. The flooding and the wetness limit recreational development in places.

2. Soils at low elevations on mountain slopes

This map unit is in rolling to steep areas on the lower part of mountain slopes and hills. The slopes mainly are on south aspects. They are exposed to the prevailing wind and are frequently blown clear of snow in the winter. The soils are underlain by granitic or volcanic rocks or by glacial drift.

This map unit makes up about 3 percent of the survey area. It is about 75 percent Borolls and 25 percent Ochrepts.

The Borolls are in grassland or shrubland and have a thick, dark surface layer. Argic Cryoborolls and Typic Cryoborolls are common. The Ochrepts are forested and have a light colored surface layer. Typic Ustochrepts and Typic Cryochrepts are common.

The forage production of the grassland and shrubland is low or moderate. The slope limits access to forage by livestock. This map unit can provide good range for deer and elk in winter. Timber productivity is very low or low. The slope limits the operation of tractors in many areas.

Soils at Mid Elevations on Mountain Slopes

These soils formed under lower subalpine forest and the associated mountain meadows. They are at elevations of 6,600 to 8,200 feet. They are mainly used for timber, as habitat for wildlife in summer, for livestock grazing, and for watershed.

3. Soils underlain by interbedded sandstone and shale

This map unit is on gently rolling to steep moraines or structurally controlled slopes.

This map unit makes up about 15 percent of the survey area. It is about 50 percent Ochrepts, 40 percent Boralfs, and 10 percent soils of minor extent.

The Ochrepts do not have an accumulation of clay in the subsoil and are underlain by sandstone. Typic Cryochrepts are common. The Boralfs have an accumulation of clay in the subsoil and are underlain by

shale. Typic Cryoboralfs and Mollic Cryoboralfs are common. Borolls, which are minor soils, are in mountain meadows. They have a thick, dark surface layer.

Timber productivity is moderate or high in the forested areas. Landslides are a hazard affecting road construction and maintenance.

4. Soils underlain by glacial outwash

This map unit is on nearly level to gently sloping glacial outwash terraces. A thin layer of silty windblown material mantles the terraces. Much of the sand in the outwash is derived from obsidian.

This map unit makes up about 2 percent of the survey area. It is about 90 percent sandy-skeletal, siliceous Typic Cryochrepts and 10 percent soils of minor extent.

The sandy-skeletal, siliceous Typic Cryochrepts are underlain by coarse textured outwash. Loamy-skeletal, mixed Typic Cryochrepts are of minor extent. They are underlain by moderately coarse textured or medium textured outwash.

Timber productivity is low in the forested areas. Regeneration of the forest is limited by moisture stress. Camping, fishing, and winter recreational activities are important uses of this map unit because of the proximity to Yellowstone National Park. Also, many of the wildlife species from the park use this unit incidental to use of habitat within the park.

5. Soils underlain by rhyolitic rocks

This map unit is on the gently sloping plateaus of lava flow. The underlying material is rhyolite, obsidian, and welded tuffs.

This map unit makes up about 2 percent of the survey area. It is about 80 percent Ochrepts and 20 percent Boralfs.

The Ochrepts are on knolls and ridges and do not have an accumulation of clay in the subsoil. Typic Cryochrepts are common. The Boralfs are in depressions and along drainageways and have an accumulation of clay in the subsoil. Typic Cryoboralfs and Mollic Cryoboralfs are common.

Timber productivity is low or moderate. The terrain is well suited to the operation of tractors. Many of the wildlife species from Yellowstone National Park use this map unit incidental to the use of habitat within the park.

6. Soils underlain by limestone

This map unit is on steep mountain slopes or structurally controlled slopes. The underlying material is limestone or dolomite.

This map unit makes up about 9 percent of the survey area. It is about 60 percent Ochrepts, 25 percent Boralfs, and 15 percent soils of minor extent and rock outcrop.

The soils in this map unit are medium textured. Some of their horizons are calcareous. The Ochrepts do not have an accumulation of clay in the subsoil. Typic Ustochrepts and Typic Cryochrepts are common. The Boralfs have an accumulation of clay in the subsoil. Typic Cryoboralfs are common. The rock outcrop is on the upper slopes. Borolls, which are minor soils, are in mountain meadows and grassland. Argic Cryoborolls and Typic Calciborolls are common.

Timber productivity is low or moderate. The slope limits the operation of tractors in places. Hunting and hiking are important recreational activities. Limestone cliffs are scenic attractions in places.

7. Soils underlain by granitic or volcanic rock

This map unit is mainly on very steep mountain slopes and glacial troughwalls. Slopes dominantly are 45 to 70 percent. Those on mountain ridges and glacial moraines in valleys are 10 to 45 percent.

This map unit makes up about 47 percent of the survey area. It is about 60 percent Ochrepts, 25 percent Boralfs, and 15 percent soils of minor extent and rock outcrop.

The Ochrepts are underlain by granitic rocks and do not have an accumulation of clay in the subsoil. Typic Cryochrepts are common. The Boralfs are underlain by volcanic rocks and have an accumulation of clay in the subsoil. Typic Cryoboralfs and Mollic Cryoboralfs are common. Borolls, which are minor soils, are in mountain meadows. The rock outcrop is in areas where the soils are underlain by granitic rocks.

Timber productivity is moderate. The slope limits the operation of tractors in places. Hunting and hiking are important recreational activities. Many areas of this map unit provide important habitat for deer, elk, mountain goat, and bear.

Soils at High Elevations on Mountain Slopes and Ridges

These soils formed under upper subalpine forest, timberline forest, and alpine meadows. They are at elevations of 8,000 to 9,000 feet or more. They are mainly used for recreational activities and as wildlife habitat.

8. Soils formed under upper subalpine and timberline forests and alpine meadows

This map unit is on mountain ridges, glacial cirque headwalls, troughwalls, and moraines. It is at elevations of 8,000 to 9,000 feet or more. The soils in this unit can

be underlain by any of the different kinds of bedrock in the survey area.

This map unit makes up about 20 percent of the survey area. It is about 50 percent Ochrepts, 35 percent Borolls, and 15 percent rock outcrop and rubble land.

The Ochrepts are in upper subalpine forest and timberline forest. They have a light colored or thin, dark surface layer. Typic Cryochrepts and Dystric Cryochrepts are common. The Borolls are in mountain meadows and alpine meadows. They have a thick, dark surface layer. The rock outcrop and rubble land are on glacial cirque headwalls and troughwalls.

The snowpack in winter is deep. The growing season is short. The soils in this map unit are used for recreational activities and as wildlife habitat. Timber productivity is very low or low. Forest regeneration is limited by the harsh climate. The grazing season for livestock is short. The landforms at the higher elevations and the vegetation provide attractive scenery for recreational users.

Detailed Soil Map Units

This section describes each map unit in detail. The map unit descriptions, along with the soil maps, can be used to determine the suitability and potential of a unit for major land uses within the survey area, to plan land use and the development of resources, and to help protect and maintain the quality of the environment. The acreage and proportionate extent of each map unit are given in table 2. Table 3 provides an alphabetical listing of the detailed soil map unit names. Many of the terms used to describe map units are defined in the "Glossary." More information for each map unit is given under the heading "Use and Management."

Most of the soils in the survey area are mapped at the family level of taxonomy, but a few are mapped at the higher levels. Map units in which soils are mapped at the family level are named using subgroup reference taxa for brevity. Table 13 gives the classification of the soils in each of the detailed soil map units.

The map unit description format presents information in sections. A description of the content of each section follows.

An introductory paragraph provides a summary of the map unit information. It describes landform, elevation, vegetation, and parent material.

Landform describes properties of the landform in the map unit. More detailed information about the landforms in the survey area is provided in the section "Landforms," which is under the heading "General Nature of the Survey Area."

Vegetation and *habitat types* describe the typical existing vegetation and the composition and distribution of habitat types. Major and similar habitat types are in the same habitat type group and have similar interpretive values for survey objectives. Included habitat types have productivity similar to that of the major habitat types, but they can have different stand composition. Dissimilar habitat types have significantly different potential productivity or limitations to forest regeneration than the major habitat types. Temperature and moisture conditions indicated by the habitat types are rated relative to conditions within the map unit. The use of vegetation and habitat types in defining, describing, and interpreting the plant growth environments within map units is described in the section "General Nature of the Survey Area."

Geology describes the bedrock underlying the soils or the properties of the geologic deposits in which the soils form. The use of geology in defining, describing, and interpreting map units is described in the section "General Nature of the Survey Area."

Characteristics of the soils describes the soil properties that are of particular importance to use and management. The properties given are the same for the dominant soils and the similar soils in the unit. The texture of the surface layer, the content of rock fragments in the subsoil, and depth to bedrock, if less than 60 inches, are important properties in this survey area. When the map unit is a complex, the most important properties of the soils and any relationship of the soils to topographic position or vegetation are described.

Map unit composition describes the soils that are similar and dissimilar to the dominant soils. It gives the percentage of the map unit typically occupied by the dominant and similar soils and by the dissimilar soils. The location and principal interpretive difference are given for dissimilar soils.

Representative profile of the soils describes the dominant soils in the map unit. It is not necessarily the same as the representative pedon for the taxa.

Management gives suitability and limitations for common land uses. *Timber, roads, range,* and *wildlife and fisheries* are described.

12-1A—Dystric Cryochrepts, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 5 to 20 percent. The mountain ridges include smooth, rounded,

convex ridgetops and the lower slopes. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is a dense forest of stunted subalpine fir, whitebark pine, lodgepole pine, and Engelmann spruce and scattered areas of mountain meadows. The stands are open grown on the ridgetops and dense on the lower side slopes. The understory is a sparse mat of shrubs dominated by grouse whortleberry and numerous forbs.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir also is in this unit at the higher elevations. A cold climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Subalpine fir/grouse whortleberry is at the lower elevations. Its productivity for timber is higher than that of the major habitat type. Idaho fescue/tufted hairgrass is in mountain meadows on ridgetops.

Geology

These soils dominantly are underlain by coarse grained rocks, such as granite or gneiss. They are underlain by rhyolite, sandstone, and mica schist in places. Deposits of glacial till weathered from local bedrock are along drainageways. A thin layer of silty loess generally mantles the surface.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Dystric Cryochrepts. They have a light colored surface layer. The similar soils have a dark surface layer. They are loamy-skeletal, mixed Typic Cryumbrepts. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are fine-loamy, mixed Typic Cryoboralfs and fine, mixed Argic Cryaquolls. The Typic Cryoboralfs are underlain by mica schist. They have a moderately fine textured subsoil and are erodible. Their productivity for timber is higher than that of the dominant soils. The Argic Cryaquolls are in meadows and are poorly drained. They have low strength. The rock outcrop is at the higher elevations and near the boundaries of the delineation.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray very gravelly loam about 4 inches thick. The subsoil is light brownish gray very cobbly loam about 8 inches thick. The substratum to a depth of 40 inches or more is light gray and white very cobbly loam.

Management

Timber

The potential annual production ranges from 16 to 32 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain.

Roads

This map unit is suitable as a site for roads that are properly located, constructed, and maintained. The material exposed during road construction is difficult to revegetate because of the harsh climate.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for grizzly bear in late summer and in fall. It also can provide good habitat for blue grouse. It provides good security cover for wildlife when the trees in the stands are pole or sapling size.

12-1C—Typic Cryochrepts, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 6,500 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 5 to 20 percent. The mountain ridges include smooth, rounded, convex ridgetops and the lower slopes. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory generally is a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry. On south-facing slopes it is dominated by pinegrass.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir/heartleaf arnica also is in this unit. A cool climate and low timber productivity are associated with these habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/bluejoint is on wet sites adjoining stream channels, and subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Subalpine fir/bluejoint has higher timber productivity and subalpine fir/whitebark pine/grouse whortleberry has lower timber productivity than that of the major habitat types.

Geology

These soils dominantly are underlain by coarse grained rocks, such as granite or gneiss. They are underlain by sandstone and rhyolite in places. Deposits of glacial till weathered from local bedrock are in depressions or valleys.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured or medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They have a light colored surface layer. The similar soils have a darker colored surface layer. They are loamy-skeletal, mixed Typic Cryumbrepts. The dominant and similar soils make up about 85 percent of the unit.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine-loamy, mixed Mollic Cryoboralfs. They are underlain by mica schist and have a moderately fine textured subsoil. They are along streams and are erodible. Their productivity for timber is higher than that of the dominant soils. The rock outcrop is at the higher elevations and near the boundaries of the delineation.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely cobbly sandy loam.

Management

Timber

The potential annual production ranges from 33 to 53 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

This map unit is suitable as a site for roads that are properly located, constructed, and maintained.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for moose in fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for wildlife when the trees in the stands are pole or sapling size.

12-2A—Mollic Cryoboralfs, volcanic substratum

This map unit is on mountain ridges. Elevation ranges from 7,200 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 5 to 20 percent. The mountain ridges include smooth, rounded, convex ridgetops and the lower slopes. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a thick mat of shrubs dominated by blue huckleberry and grouse whortleberry with some elk sedge.

Habitat Types

Subalpine fir/grouse whortleberry, subalpine fir/blue huckleberry, and subalpine fir/elk sedge are the major habitat types. Subalpine fir/twinflower also is in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Subalpine fir/whitebark pine/grouse whortleberry, which is a dissimilar habitat type, is in about 20 percent of the unit. It is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Regeneration of the forest is limited by the climate.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. The welded tuffs are in isolated layers and are not commonly exposed. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a dark surface layer. The similar soils have a lighter colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 85 percent of the unit.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts. They are near areas of rock outcrop. They have a medium textured subsoil. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is at the higher elevations and near the boundaries of the delineation.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

Unsurfaced roads are slick when wet.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose in fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for wildlife when the trees in the stands are pole or sapling size.

12-2B—Mollic Cryoboralfs, volcanic substratum, cold

This map unit is on mountain ridges. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 5 to 20 percent. The mountain ridges include smooth, rounded, convex ridgetops and the lower slopes. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is a dense forest of stunted subalpine fir, whitebark pine, lodgepole pine, and Engelmann spruce and scattered areas of mountain meadows. The understory is a sparse mat of grouse whortleberry with numerous forbs.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir also is in this unit at the higher elevations. A cold climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Subalpine fir/grouse whortleberry is at the lower elevations. Its productivity for timber is higher than that of the major habitat type. Idaho fescue/tufted hairgrass is in mountain meadows.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. The welded tuffs are in isolated layers and are not commonly exposed. The lava flows are resistant to weathering. The tuffs weather rapidly. A thin layer of silty loess mantles the surface.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a dark surface layer. The similar soils have a lighter colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils and rock outcrop make up about 20 percent of this unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and fine-loamy, mixed Argic Cryoborolls. The Typic Cryochrepts are near areas of rock outcrop. They do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The Argic Cryoborolls are in mountain meadows. The rock outcrop is at the higher elevations and near the boundaries of the delineation.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 16 to 32 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain.

Roads

Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of the harsh climate.

Range

The mountain meadows are in about 5 percent of the unit but produce more than 90 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for grizzly bear in summer and fall. It provides good security cover for wildlife when the trees in the stands are pole or sapling size.

13-1A—Dystric Cryochrepts-Rock outcrop complex, alpine meadows

This map unit is on mountain ridges. Elevation ranges from 9,000 to 9,800 feet. The vegetation consists of alpine meadows. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain ridges include broad, convex ridgetops and plateaus. Patterned ground and other features caused by frost action are common. Strong winds sweep exposed ridges partially free of snow in winter. Persistent snowbanks are common on north-facing slopes. In areas where snowbanks persist, the soils generally are bare after the snow melts. The soils on the landforms have high water-holding capacity; however, considerable surface runoff occurs when the snow melts.

Vegetation

The alpine meadows are dominated by tufted hairgrass, Idaho fescue, and a variety of sedges. Arctic willow is in wet meadows. The harsh climate limits the height of meadow plants to less than 6 inches. The vegetation is similar in size and shape to that growing in areas of arctic tundra.

Habitat Types

Idaho fescue/tufted hairgrass is the major habitat type. Whitebark pine/subalpine fir also is in this unit. A very cold climate and moderately productive mountain meadows are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Tufted hairgrass/sedge, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in the included wet areas. Its productivity for forage is higher than that of the major habitat type.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by rhyolite, mica schist, or sandstone in places. A thin layer of silty loess generally mantles the surface.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are sandy-skeletal, mixed Dystric Cryochrepts. They have a light colored surface layer and are more than 60 inches deep. The similar soils

have a dark surface layer or are 4 to 20 inches deep over bedrock. They are sandy-skeletal, mixed Typic Cryumbrepts and sandy-skeletal, mixed Lithic Cryochrepts. The dominant and similar soils make up about 65 percent of the unit.

The Rock outcrop is on high points. Rubble land is a similar component in this unit. The Rock outcrop and Rubble land make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are fine-loamy, mixed Typic Cryochrepts and fine-loamy, mixed Typic Cryaquolls. The Typic Cryochrepts are underlain by mica schist and have a moderately coarse textured subsoil. They are more susceptible to erosion than the dominant soils. The Typic Cryaquolls are near snowbanks or seeps and are poorly drained. They have low strength.

Representative Profile of the Soils

The dominant soils are light gray loam in the upper 1 inch of the surface layer. The lower 6 inches of the surface layer is pale brown very cobbly sandy loam. The subsoil is yellowish brown very gravelly sandy loam about 9 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loamy sand.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Hard rock limits excavation in places. Unsurfaced roads are rough and difficult to blade because of large stones. The soils contain many vertical wedges of angular cobbles. Water rapidly moves through these wedges when snow melts on the steeper slopes. In areas where roadcuts intersect the wedges, a drainage system should be provided. The material exposed during road construction is difficult to revegetate because of the harsh climate and moisture stress.

Range

The average production for the potential native plant communities is about 1,230 pounds per acre of air-dry herbage in a normal year. The snow cover limits the length of the grazing season. Grazing should be delayed until the soils have sufficiently dried out and are firm enough to withstand trampling by livestock. Loose herding of sheep is particularly important for proper forage utilization in these alpine meadows.

Wildlife and fisheries

This map unit can provide good habitat for bighorn sheep and mountain goats in summer and fall. It provides them with some habitat on windswept ridges in winter. Occasionally, it is heavily used by adult mule deer.

13-2A—Typic Cryochrepts-Argic Cryoborolls association, cold

This map unit is on mountain ridges. Elevation ranges from 9,000 to 9,800 feet. The vegetation consists of alpine meadows. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain ridges include smooth, rounded, convex ridgetops and plateaus. Patterned ground and other features caused by frost action are common. Strong winds sweep exposed ridges partially free of snow in winter. Persistent snowbanks are common on north-facing slopes. In areas where snowbanks persist, the soils generally are bare after the snow melts. The soils on the landforms have high water-holding capacity; however, considerable surface runoff occurs when the snow melts.

Vegetation

The alpine meadows are dominated by tufted hairgrass, Idaho fescue, and a variety of sedges. The harsh climate limits the height of meadow plants to less than 6 inches. The vegetation is similar in size and shape to that growing in areas of arctic tundra.

Habitat Types

Idaho fescue/tufted hairgrass is the major habitat type. Whitebark pine/subalpine fir also is in this unit. A very cold, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 90 percent of the unit.

Tufted hairgrass/sedge, which is a dissimilar habitat type, is in about 5 percent of the unit. It is in poorly drained areas. Its productivity for forage is higher than that of the major habitat type.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. The welded tuffs are in isolated layers and are not commonly exposed. The lava flows are resistant to weathering. The tuffs weather rapidly. A thin layer of silty loess generally mantles the surface.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subrounded rock fragments in the subsoil ranges from 15 to 50 percent. Soil properties are not obviously associated with landscape features in this unit. Soils having a light colored surface layer and no accumulation of clay in the subsoil and those having a dark surface layer and an accumulation of clay in the subsoil are both in the unit.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts and fine-loamy, mixed Argic Cryoborolls.

The Typic Cryochrepts have a light colored surface layer and do not have an accumulation of clay in the subsoil. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils are fine-loamy, mixed Typic Cryochrepts. The content of rock fragments in their subsoil ranges from 15 to 35 percent. These dominant and similar soils make up about 50 percent of the unit.

The Argic Cryoborolls have a dark surface layer and an accumulation of clay in the subsoil. The similar soils do not have an accumulation of clay in the subsoil. They are fine-loamy, mixed Typic Cryoborolls. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine-loamy, mixed Argic Pachic Cryoborolls and fine, mixed Argic Cryaquolls. They are in swales or around seeps and are somewhat poorly drained or poorly drained. Their productivity for timber is higher than that of the dominant soils. They have low strength. The rock outcrop is at the higher elevations.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely cobbly clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is light yellowish brown clay loam about 34 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to slough and erode and is difficult to revegetate because of the harsh climate. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. The soils contain many vertical wedges of angular cobbles. Water rapidly moves through these wedges when snow melts on the steeper slopes. In areas where roadcuts intersect the wedges, a drainage system should be provided.

Range

The average production for the potential native plant communities is about 1,360 pounds per acre of air-dry herbage in a normal year. The snow cover limits the length of the grazing season. Grazing should be delayed until the soils have sufficiently dried out and are firm enough to withstand trampling by livestock. Loose herding of sheep is particularly important for proper forage utilization in these alpine meadows.

Wildlife and fisheries

This map unit can provide good habitat for bighorn sheep in fall and for mountain goats in summer and fall. It provides them with some habitat on windswept ridges in winter. The area around Windy Pass occasionally is used heavily by elk in summer.

22-1A—Dystric Cryochrepts-Rock outcrop complex, granitic substratum

This map unit is on glacial cirque headwalls and trough walls. Elevation ranges from 7,600 to 8,500 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glacial cirque headwalls and trough walls are concave slopes forming the headwalls around cirque basins and the side slopes in glacial valleys. Snow avalanches, cutbank ravel, and rockslides frequently occur in this map unit. On the upper slopes, water-holding capacity is low and surface runoff occurs when the snow melts. On the lower slopes, water-holding capacity is high and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a dense mat of grouse whortleberry, blue huckleberry, and pinegrass.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/

blue huckleberry are the major habitat types. Subalpine fir/heartleaf arnica also is in this unit. Subalpine fir/pinegrass is on south-facing slopes. A cool, moist climate and low forest productivity are associated with these habitat types in this unit. These habitat types are in about 60 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/Sitka alder is on north-facing slopes. Its productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Douglas-fir/snowberry is on south-facing slopes at the lower elevations where regeneration of the forest is limited by moisture stress.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. These rocks weather slowly. They are exposed at the higher elevations of the unit. The unit is underlain by sandstone, mica schist, or intrusive stocks in places.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured or medium textured surface layer. The content of angular and subrounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are sandy-skeletal, mixed Dystric Cryochrepts. They are 20 to more than 60 inches deep over bedrock. The similar soils are 4 to 40 inches deep over bedrock. They are sandy-skeletal, mixed Lithic Cryochrepts. The dominant and similar soils make up about 70 percent of the unit.

The Rock outcrop forms cliffs on the upper slopes. Rubble land is a similar component in this unit. It is in areas below the areas of Rock outcrop and at the base of slopes. The Rock outcrop and Rubble land make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryochrepts. They are underlain by mica schist. They are moderately fine textured and are more susceptible to erosion than the dominant soils.

Representative Profile of the Soils

The dominant soils are light gray loam in the upper 1 inch of the surface layer. The lower 6 inches of the surface layer is pale brown very cobbly sandy loam. The subsoil is yellowish brown very cobbly sandy loam about 9 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loamy sand.

Management

Timber

The potential annual production ranges from 15 to 53 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by moisture stress.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of the harsh climate and moisture stress. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. On the lower slopes, however, it does provide good security cover for elk and mule deer.

22-1B—Typic Ustochrepts-Rock outcrop-Typic Haploborolls complex, cirque headwalls

This map unit is on glacial cirque headwalls and trough walls. Elevation ranges from 5,800 to 7,600 feet. The vegetation consists of mountain grassland and open-grown forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes are on south aspects. They have gradients of 45 to 70 percent. The glacial cirque headwalls and trough walls are concave slopes forming the headwalls around cirque basins and the side slopes in glacial valleys. Snow avalanches and cutbank ravel occasionally occur in this map unit. The soils on the upper slopes of these landforms have low water-holding capacity. Surface runoff, which is rapid, occurs during snowmelt and intense storms.

Vegetation

The vegetation is in a complex pattern of open-grown Douglas-fir forest and mountain grassland. The forest understory is dominated by bunchgrasses. The mountain grassland contains bluebunch wheatgrass, Idaho fescue, western needlegrass, and junegrass. Douglas-fir seedlings invade the mountain grassland in places.

Habitat Types

Douglas-fir/Idaho fescue is the major habitat type in the open-grown forest. Limber pine and Douglas-fir habitat types also are in the open-grown forest. They have an understory of bunchgrass. Idaho fescue/bluebunch wheatgrass is the major habitat type in the mountain grassland. A warm, dry climate and low timber and forage productivity are associated with these habitat types in this unit. These habitat types are in about 50 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Douglas-fir/snowberry is at the lower elevations, and subalpine fir/pinegrass is at the higher elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by sandstone or intrusive stocks in places.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured or medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under open-grown forest have a light colored surface layer, whereas soils that formed under mountain grassland have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Ustochrepts and loamy-skeletal, mixed Typic Haploborolls.

The Typic Ustochrepts are in areas of open-grown forest. They do not have an accumulation of clay in the subsoil. The similar soils have an accumulation of clay in the subsoil. They are loamy-skeletal, mixed Typic Eutroboralfs. These dominant and similar soils make up about 40 percent of the unit.

The Rock outcrop forms cliffs on the upper slopes. Rubble land is a similar component in this unit. It is in areas below the areas of Rock outcrop and at the base of slopes. The Rock outcrop and Rubble land make up about 30 percent of the unit.

The Typic Haploborolls are in areas of mountain grassland. They make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Lithic Ustochrepts. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Ustochrepts have a surface layer of light brownish gray gravelly sandy loam about 6 inches thick. The upper part of the subsoil is brown very cobbly loam about 2 inches thick. The lower part is yellowish red very cobbly loam about 11 inches thick. The substratum to a depth of 60 inches or more is light reddish brown very stony sandy loam.

The Typic Haploborolls have a surface layer of very gravelly loam about 14 inches thick. The upper 9 inches of the surface layer is dark grayish brown, and the lower 5 inches is brown. The subsoil is light yellowish brown very gravelly sandy loam about 10 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very gravelly sandy loam.

Management

Timber

The potential annual production ranges from 16 to 26 cubic feet per acre. Timber productivity in the map unit is limited by the Rock outcrop and the mountain grassland. The slope affects the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

Unsurfaced roads are rough and difficult to blade because of large stones. The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel.

Range

The slope and insufficient water for livestock are limitations affecting range. Livestock tend to gather in the small, included areas of less sloping soils. Building drift fences, herding, and locating salting facilities away from the water help to overcome these limitations. The forest understory produces a moderate amount of forage. Productivity increases following timber harvest. The forested areas are moderately suited to transitory

range. The average production for the potential native plant communities in the mountain grassland is about 890 pounds per acre of air-dry herbage in a normal year.

Wildlife and fisheries

This map unit can provide good habitat for mountain goats and bighorn sheep in winter. It also can provide good habitat for blue grouse and good nesting habitat for raptors that nest on cliffs.

22-1C—Rock outcrop-Typic Cryochrepts complex, cirque headwalls

This map unit is on glacial cirque headwalls and trough walls. Elevation ranges from 8,200 to 9,500 feet. The vegetation consists of timberline forest and alpine meadows. The soils formed in material weathered from granitic or volcanic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glacial cirque headwalls and trough walls are concave slopes forming the headwalls around cirque basins and the side slopes in glacial valleys. Snow avalanches and rockslides frequently occur in this map unit. The soils on the landforms have low water-holding capacity, and the potential for surface runoff is high.

Vegetation

The upper slopes are barren except for lichens or mosses on rocks. The vegetation on the lower slopes is isolated stands of stunted whitebark pine and subalpine fir or scattered areas of alpine meadows.

Habitat Types

Whitebark pine/subalpine fir and Idaho fescue/tufted hairgrass are the major habitat types. A very cold climate and very low timber and forage productivity are associated with these habitat types in this map unit. These habitat types are in about 40 percent of the unit.

Subalpine fir/whitebark pine/grouse whortleberry, which is a dissimilar habitat type, is in about 10 percent of the unit. It is at the lower elevations. Its productivity for timber is higher than that of the major habitat types.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss, or a repetitive sequence of lava flows and mudflow breccias. Some delineations are underlain entirely by granite or gneiss. Other delineations are underlain by thin, interbedded layers of sandstone and shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular and rounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The Rock outcrop forms cliffs on the upper slopes. Rubble land is a similar component in this unit. It is in areas below the areas of Rock outcrop and at the base of slopes. The Rock outcrop and Rubble land make up about 60 percent of the unit.

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They are on the lower slopes and are very cobbly loam or very cobbly sandy loam in the lower part of the subsoil. The similar soils are very cobbly loamy sand in the lower part of the subsoil. They are sandy-skeletal, mixed Dystric Cryochrepts. The dominant and similar soils make up about 40 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of the harsh climate and moisture stress. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

This map unit produces a limited amount of forage. The slope severely limits access to forage.

Wildlife and fisheries

This map unit can provide good habitat for bighorn sheep and mountain goats in summer and fall. It also can provide them with habitat on windswept ridges in winter. It provides good security cover for mule deer.

22-2A—Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, cirque headwalls

This map unit is on glacial cirque headwalls and trough walls. Elevation ranges from 7,600 to 8,500 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glacial cirque headwalls and trough walls are concave slopes forming the headwalls around cirque basins and the side slopes in glacial valleys. Springs and seeps are common in this map unit. Landslides are commonly associated with the seeps and springs. Avalanches frequently occur in this unit. The water-holding capacity is low on the upper slopes and high on the lower slopes. The potential for surface runoff is low on the lower slopes.

Vegetation

The vegetation is dense lodgepole pine forest and scattered areas of meadows. The forest understory is a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/ blue huckleberry are the major habitat types in the drier areas of this map unit. Subalpine fir/twinflower is the major habitat type on moist, north-facing slopes. Subalpine fir/heartleaf arnica also is in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 65 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/bluejoint is in moist areas near seeps. Its productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/ grouse whortleberry is at the cold, upper elevations. Its productivity for timber is lower than that of the major habitat types. Douglas-fir/snowberry is at the warm, lower elevations where moisture stress limits regeneration of the forest. Idaho fescue/bearded wheatgrass is in scattered areas of mountain meadows.

Geology

This map unit is underlain by thick beds of light colored sandstone and multicolored shale. Shale outcrops add color to the local landscape. Sandstone forms ridges and outcrops. The landslides are associated with the shale beds. The seeps commonly are along the contact between sandstone and shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of flat or subangular rock fragments in the subsoil ranges from 20 to 65 percent. Soil properties vary depending on the parent material. Soils that formed in material weathered from shale have an accumulation of clay in the subsoil, whereas soils that formed in material weathered from sandstone do not have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs formed in material weathered from shale. The content of rock fragments in their subsoil ranges from 35 to 65 percent. The similar soils are fine-loamy, mixed Typic Cryoboralfs. The content of rock fragments in their subsoil ranges from 20 to 35 percent. These dominant and similar soils make up about 30 percent of the unit.

The Typic Cryochrepts formed in material weathered from sandstone. They make up about 30 percent of the unit.

The Rock outcrop forms cliffs on the upper slopes. Rubble land is a similar component in this unit. It is in areas below the areas of Rock outcrop and at the base of slopes. The Rock outcrop and Rubble land make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 20 percent of the unit. They are Cryaquolls and fine-loamy, mixed Argic Cryoborolls. The Cryaquolls are near seeps and springs. They have low strength. The Argic Cryoborolls are in meadows. They have a dark surface layer.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper 29 inches of the subsoil is pale brown cobbly loam and very stony loam. The lower 12 inches is pale brown very stony clay loam. The substratum to a depth of 60 inches or more is pale brown very stony loam.

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely cobbly sandy loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. Productivity in the map unit is

limited by the Rock outcrop. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode. The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Avalanches can increase the cost of maintaining the roads.

Range

The slope severely limits access to forage. Livestock tend to gather in the small, included areas of less sloping soils. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose.

22-3A—Typic Cryochrepts-Rock outcrop complex, volcanic substratum

This map unit is on glacial cirque headwalls and trough walls. Elevation ranges from 7,600 to 8,500 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glacial cirque headwalls and trough walls are concave slopes forming the headwalls around cirque basins and the side slopes in glacial valleys. Avalanches frequently occur in this map unit. These landforms have a moderate risk of landslides, and the slopes tend to ravel. The water-holding capacity is low on the upper slopes and high on the lower slopes. Surface runoff occurs during snowmelt and intense storms on the upper slopes. It is slow on the lower slopes.

Vegetation

The vegetation is dense lodgepole pine forest and scattered areas of mountain grassland. The forest understory is a thick mat of shrubs and grasses. Grouse whortleberry, blue huckleberry, and pinegrass are the dominant species.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types on north-facing slopes. Subalpine fir/pinegrass is the major habitat type on south-facing slopes at the higher elevations. Douglas-fir/pinegrass, Douglas-fir/snowberry, and subalpine fir/heartleaf arnica are at the lower elevations. A cool climate and low or moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 65 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Idaho fescue/bluebunch wheatgrass is in the mountain grassland. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. The welded tuffs are in isolated layers and are not commonly exposed. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subangular rock fragments in the subsoil ranges from 35 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They are 20 to more than 60 inches deep over bedrock. The similar soils are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed Lithic Cryochrepts. The dominant and similar soils make up about 60 percent of the unit.

The Rock outcrop forms cliffs on the upper slopes. Rubble land is a similar component in this unit. It is in areas below the areas of Rock outcrop and at the base of slopes. The Rock outcrop and Rubble land make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 20 percent of the unit. They are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls. The Typic Cryoboralfs are on the lower, north-facing slopes. They are moderately fine textured and have an accumulation of clay in the subsoil. Their productivity for timber is higher than that of the dominant soils. The Argic Cryoborolls are in the mountain grassland. They have a dark surface layer.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly loam about 13 inches thick. The substratum to a depth of 60 inches or more also is very pale brown very cobbly loam.

Management

Timber

The potential annual production ranges from 33 to 53 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope and the Rock outcrop limit the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. Avalanches can increase the cost of maintaining the roads. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The slope limits access to forage. The forest understory produces a limited amount of forage.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose.

22-3C—Typic Cryochrepts-Rock outcrop-Cryaquolls complex, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 8,200 to 8,600 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 5 to 20 percent. The mountain ridges are rolling, undissected, and glacially scoured. Small lakes, ponds, and bogs are throughout the unit. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest and scattered areas of wet meadows. The forest understory is a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir/heartleaf arnica and subalpine fir/twinflower also are in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 65 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/bluejoint is in poorly drained areas. Its productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Tufted hairgrass/sedge is in the wet meadows.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. Deposits of glacial till weathered from the underlying bedrock are in depressions. The unit is underlain by mica schist in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the topography. Soils on ridges are well drained, whereas soils in valleys and depressions are poorly drained.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls.

The Typic Cryachrepts are very cobbly sandy loam in the lower part of the subsoil. The similar soils are very cobbly loamy sand in the lower part of the subsoil. They are sandy-skeletal, mixed Typic Cryochrepts. The dominant and similar soils make up about 55 percent of the unit.

The Rock outcrop is on ridgetops. Rubble land is a similar component in this unit. The Rock outcrop and Rubble land make up about 20 percent of the unit.

The Cryaquolls are in valleys and depressions. They make up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryoboralfs. They are underlain by mica schist and are moderately fine

textured. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely cobbly sandy loam.

No one profile can represent the Cryaquolls in this unit. In one of the more common profiles, however, the soils have a surface layer of dark grayish brown silt loam about 9 inches thick. The subsoil is very pale brown sandy clay loam about 5 inches thick. It is mottled with strong brown. The substratum to a depth of 60 inches or more is light gray gravelly sandy clay loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The operation of tractors is limited by low strength in wet areas. Operating tractors in wet areas also results in compaction and the formation of ruts.

Roads

Hard rock limits excavation in places. Roads should not be built in wet areas in valleys and depressions. Providing suitable subgrade material helps to prevent the damage caused by wetness. The material exposed on steep cutbanks during road construction tends to ravel. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for moose in summer and fall and for grizzly bear in summer. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

25-1A—Dystric Cryochrepts-Rock outcrop complex, cirque basins

This map unit is in glacial cirque basins. Elevation ranges from 8,000 to 9,500 feet. The vegetation consists of alpine meadows. The soils formed in glacial till and material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 5 to 20 percent. The glacial cirque basins are at the head of U-shaped valleys. Some small ponds, lakes, seeps, springs, and bogs are in this unit. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

The alpine meadows contain tufted hairgrass, Idaho fescue, sedges, and abundant forbs. They also include scattered areas of stunted subalpine fir, Engelmann spruce, and whitebark pine. The harsh alpine climate limits the height of the meadow vegetation to less than 6 inches. The vegetation is similar in size and shape to that growing in areas of arctic tundra.

Habitat Types

Idaho fescue/tufted hairgrass is the major habitat type. A very cold alpine climate and moderate forage productivity is associated with this habitat type in this unit. This habitat type is in about 60 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Tufted hairgrass/sedges is in areas of poorly drained soils around bogs, springs, and lakes. Its productivity for forage is higher than that of the major habitat type. Whitebark pine/subalpine fir is in the forested areas.

Geology

This map unit is underlain by coarse grained rocks, such as granite or gneiss. Thin deposits of glacial till that weathered from the underlying bedrock are on concave slopes. The surface is mantled by a thin layer of silty loess in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subrounded rock fragments in the subsoil ranges from 35 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Dystric Cryochrepts. They are 20 to 40 inches deep over bedrock. The similar soils are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed Lithic Cryochrepts. The dominant and similar soils make up about 65 percent of the unit.

The Rock outcrop is in areas throughout this map unit. Rubble land is a similar component in the unit. The Rock outcrop and Rubble land make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are Cryaquepts and Cryaquents. The Cryaquepts are near seeps and springs. The Cryaquents are along the edge of lakes. They are poorly drained and have low strength. Their productivity for forage is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray very gravelly loam about 4 inches thick. The subsoil is light brownish gray very cobbly sandy loam about 8 inches thick. The substratum to a depth of 40 inches or more is white extremely cobbly sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of the harsh climate and moisture stress. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The average production for the potential native plant communities is about 1,230 pounds per acre of air-dry herbage in a normal year. The snow cover, which lasts for much of the year, and low soil strength severely limit the length of the grazing season. Delaying grazing in the spring until the soils have dried out helps to prevent the damage caused by trampling. Loose herding of sheep is particularly important for proper forage utilization.

Wildlife and fisheries

This map unit can provide good habitat for elk in summer and fall and for grizzly bear, mountain goats, and bighorn sheep in summer. The lakes in the unit provide some habitat for trout.

25-3A—Argic Cryoborolls-Typic Cryoboralfs-Rock outcrop complex, cirque basins

This map unit is in glacial cirque basins. Elevation ranges from 8,000 to 9,500 feet. The vegetation consists of alpine meadows and timberline forest. The soils formed in glacial drift and material weathered from volcanic rocks or interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 5 to 20 percent. The glacial cirque basins are at the head of U-shaped valleys. Some small lakes, seeps, springs, and bogs are in this unit. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

The vegetation is a timberline forest of stunted subalpine fir, Engelmann spruce, and whitebark pine. Tufted hairgrass, Idaho fescue, sedges, and forbs dominate the alpine meadows. The alpine climate limits the growth of meadow vegetation to less than 6 inches. The vegetation is similar in size and shape to that growing in areas of arctic tundra.

Habitat Types

Idaho fescue/tufted hairgrass is the major habitat type in the alpine meadows. It is in about 30 percent of the unit. Whitebark pine/subalpine fir is the major habitat type under timberline forest. It also is in about 30 percent of the unit. A cold alpine climate, moderate forage productivity, and very low timber productivity are associated with these habitat types in this unit.

Tufted hairgrass/sedges, which is a dissimilar habitat type, is in about 15 percent of the unit. It is in poorly drained areas around bogs, springs, and seeps. Its productivity for forage is higher than that of the major habitat types.

Geology

This unit is underlain by a repetitive sequence of lava flows and mudflow breccias or interbedded sandstone and shale. Thin deposits of glacial till that weathered from local bedrock are in depressions. The surface is mantled by a thin layer of silty loess in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 10 to 50 percent. Soil properties vary depending on the topography. Soils on concave slopes have a dark surface layer, whereas soils on convex slopes have a light colored surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Typic Cryoboralfs.

The Argic Cryoborolls are on concave slopes. They have a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a 35 to 50 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Argic Cryoborolls. These dominant and similar soils make up about 35 percent of the unit.

The Typic Cryoboralfs are on convex slopes. They have a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a 35 to 50 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Typic Cryoboralfs. These dominant and similar soils make up about 30 percent of the unit.

The Rock outcrop is in areas throughout this map unit. Rubble land is a similar component in the unit. The Rock outcrop and Rubble land make up about 25 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Cryaquolls, which are dissimilar soils, make up about 10 percent of the unit. They are near seeps and springs or along the edge of lakes. They are poorly drained and have low strength.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is light yellowish brown clay loam about 34 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Management

Timber

Potential annual production in forested areas is less than 20 cubic feet per acre. Timber productivity in the map unit is limited by the Rock outcrop and the alpine meadows. The Rock outcrop limits the operation of tractors. Regeneration of the forest is limited by the harsh climate.

Roads

The material exposed on steep cutbanks during road construction tends to slough and is difficult to revegetate because of the harsh climate and moisture stress. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,360 pounds per acre of air-dry herbage in a normal year. The snow cover, which lasts for much of the year, and low soil strength limit the length of the grazing season. Delaying grazing in the spring until the soils have dried out helps to prevent the damage caused by trampling. The vegetation and soils in the poorly drained, included areas are susceptible to damage from trampling year round. Loose herding of sheep is particularly important for proper forage utilization.

Wildlife and fisheries

This map unit can provide good habitat for elk in summer and fall and for mountain goats, bighorn sheep, and grizzly bear in summer. The streams and lakes in the unit provide habitat for trout.

34-1A—Dystric Cryochrepts, glacial drift substratum

This map unit is on moraines. Elevation ranges from 7,600 to 8,500 feet. The vegetation consists of upper subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Also included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and some small lakes, ponds, and bogs. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is a dense forest of stunted whitebark pine, subalpine fir, and Engelmann spruce. The understory is a sparse mat of grouse whortleberry or heartleaf arnica.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir also is in this unit at the higher elevations. A cold climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are at the lower elevations. Subalpine fir/heartleaf arnica is in scattered, protected areas. These habitat types have higher productivity for timber than that of the major habitat type.

Geology

These soils are underlain by glacial drift weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subrounded rock fragments in the subsoil ranges from 15 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Dystric Cryochrepts. They have a light colored surface layer. They are moderately acid in the subsoil and have a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a darker colored surface layer, are slightly acid in the subsoil, or have a 15 to 35 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Typic Cryumbrepts; loamy-skeletal, mixed Typic Cryochrepts; and coarse-loamy, mixed Dystric Cryochrepts. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Mollic Cryoboralfs and fine, mixed Argic Cryaquolls. The Mollic Cryoboralfs are moderately fine textured. They formed in finer textured glacial drift and are less erodible than the dominant soils. Their productivity for timber is higher than that of the dominant soils. The Argic Cryaquolls are in depressions. They are poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray very gravelly loam about 4 inches thick. The subsoil is light brownish gray very cobbly sandy loam about 8 inches thick. The substratum to a depth of 40 inches or more is light gray and white very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 16 to 32 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain.

Roads

The material exposed on steep cutbanks during road construction tends to ravel. It is difficult to revegetate because of the harsh climate.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for elk and grizzly bear in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose when the trees in the stands are pole or sapling size. It can provide good habitat for blue grouse in fall and winter. The major streams in the unit provide habitat for trout.

34-1B—Argic Cryoborolls and Typic Cryoborolls, glacial drift substratum

This map unit is on moraines. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of mountain shrubland. The soils formed in glacial drift.

Landform

The dominant slopes are on south aspects. They have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift generally near the bottom of U-shaped valleys and glaciated basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, and gently sloping flood plains and terraces, which are along the larger streams at the lower elevations. The landforms are not subject to landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is mountain shrubland and scattered stands of open-grown Douglas-fir. The mountain shrubland has a dense canopy of big sagebrush and an understory dominated by Idaho fescue, bluebunch wheatgrass, and junegrass.

Habitat Types

Big sagebrush/Idaho fescue is the major habitat type. Idaho fescue/bluebunch wheatgrass also is in this unit. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. They include Douglas-fir/snowberry, Douglas-fir/Idaho fescue, and subalpine fir/blue huckleberry. Low sage/Idaho fescue is near Gardiner. Its productivity for forage is much lower than that of the major habitat type.

Geology

These soils are underlain by glacial drift weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured

surface layer. The content of subrounded rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the texture of the glacial drift. Soils that formed in moderately fine textured drift have an accumulation of clay in the subsoil, whereas soils that formed in moderately coarse textured drift do not have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Argic Cryoborolls and loamy-skeletal, mixed Typic Cryoborolls.

The Argic Cryoborolls have an accumulation of clay in the subsoil and a dark surface layer. They are near Hebgen Lake and Gardiner. The similar soils have a thick, dark surface layer and are in swales and depressions. They are loamy-skeletal, mixed Argic Pachic Cryoborolls.

The Typic Cryoborolls do not have an accumulation of clay in the subsoil. They have a dark surface layer and are in the Absaroka Range. The similar soils have a thick, dark surface layer and are in swales and depressions. They are loamy-skeletal, mixed Pachic Cryoborolls.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Mollic Cryoboralfs. They are in forested areas. They have a light colored surface layer. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam, very gravelly clay loam, and very cobbly loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

The Typic Cryoborolls have a surface layer of dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is dark grayish brown very gravelly sandy loam about 9 inches thick. The lower part is dark grayish brown very cobbly sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to ravel.

Range

The average production for the potential native plant communities is about 1,410 pounds per acre of air-dry herbage in a normal year. Lower productivity is associated with the low sage/Idaho fescue habitat type near Gardiner.

Wildlife and fisheries

This map unit can provide good habitat for elk in winter, for grizzly bear in spring, and for mule deer year round.

34-1C—Typic Cryochrepts, glacial drift substratum

This map unit is on moraines. Elevation ranges from 6,700 to 7,900 feet. The vegetation consists of lower subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes are on north aspects. They have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, and gently sloping flood plains and terraces, which are along the larger streams at the lower elevations. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a thick mat of grouse whortleberry, blue huckleberry, and pinegrass.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir/pinegrass is on south-facing slopes. Subalpine fir/heartleaf arnica and subalpine fir/twinflower habitat types also are in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/bluejoint is near lakes, ponds, and bogs. Its productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity

for timber is lower than that of the major habitat types. Regeneration of subalpine fir/whitebark pine/grouse whortleberry is severely limited by the climate.

Geology

These soils are underlain by glacial drift weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subrounded rock fragments in the subsoil ranges from 35 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryaquepts. The Typic Cryoboralfs formed in finer textured glacial drift. Their productivity for timber is higher than that of the dominant soils. The Typic Cryaquepts are in depressions. They are poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more also is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

The material exposed on steep cutbanks during road construction tends to ravel and erode.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for moose in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

34-1D—Typic Cryochrepts-Typic Cryoborolls complex, glacial drift substratum

This map unit is on moraines. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of open-grown forest and dense Douglas-fir forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and some small lakes, ponds, and bogs. The soils on the landforms have high water-holding capacity, and runoff is low.

Vegetation

The vegetation is open-grown forest, dense Douglas-fir forest, and some mountain shrubland. The forest understory is dominated by shrubs and bunchgrasses.

Habitat Types

Douglas-fir/ninebark is the major habitat type on north and east aspects. Douglas-fir/snowberry and Douglas-fir/Idaho fescue are the major habitat types on south and west aspects. A cool or warm climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/blue huckleberry is on north-facing slopes at the higher elevations. Its productivity for timber is higher than that of the major habitat type. Big sagebrush/Idaho fescue is in scattered areas of mountain shrubland.

Geology

These soils are underlain by glacial drift weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit are moderately coarse textured or medium textured. The content of subrounded rock fragments in the subsoil ranges from 35 to 60 percent. Soil properties vary depending on the vegetation. Soils that formed under dense Douglas-fir forest have a light colored surface layer, whereas soils that formed under open-grown Douglas-fir forest have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic

Cryochrepts and loamy-skeletal, mixed Typic Cryoborolls.

The Typic Cryochrepts formed under dense Douglas-fir forest. They make up about 75 percent of the unit.

The Typic Cryoborolls formed under open-grown Douglas-fir forest. They have a dark surface layer. The similar soils have a thick, dark surface layer. They are loamy-skeletal, mixed Pachic Cryoborolls. These dominant and similar soils make up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 10 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryoboralfs. They are in swales and depressions and have an accumulation of clay in the subsoil. They are less erodible than the dominant soils. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

The Typic Cryoborolls have a surface layer of dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is dark grayish brown very gravelly sandy loam about 9 inches thick. The lower part is dark grayish brown very cobbly sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly sandy loam.

Management

Timber

The potential annual production is 12 to 30 cubic feet per acre in the open-grown forest and 15 to 51 cubic feet per acre in the dense Douglas-fir forest. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

The material exposed on steep cutbanks during road construction tends to erode and ravel.

Range

The mountain shrubland is in less than 10 percent of the unit but produces more than 90 percent of the forage. Because the forage is in widely scattered areas, however, access to it is limited. The forest understory produces only a limited amount of forage, but productivity increases following timber harvest. The forested areas are well suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall and for elk in fall. It also can provide good habitat for blue grouse. It provides good security cover for mule deer. The major streams in the unit provide habitat for trout.

34-2C—Mollic Cryoboralfs-Argic Cryoborolls association, cold

This map unit is on moraines. Elevation ranges from 8,000 to 8,500 feet. The vegetation consists of upper subalpine forest and mountain meadows. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and some small lakes, ponds, and bogs. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and runoff is low.

Vegetation

The vegetation is a dense forest of stunted whitebark pine, subalpine fir, and Engelmann spruce and scattered areas of mountain meadows. The forest understory is a sparse mat of grouse whortleberry or heartleaf arnica. The vegetation in the mountain meadows includes bearded wheatgrass, mountain brome, timber oatgrass, sticky geranium, and abundant forbs.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type in forested areas. Whitebark pine/subalpine fir also is in this unit at the higher elevations. These habitat types are in about 50 percent of the unit. Idaho fescue/bearded wheatgrass is the major habitat type in the mountain meadows. This habitat type is in about 30 percent of the unit. A cold climate, low timber productivity, and moderate forage productivity are associated with these habitat types in this unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/blue huckleberry is at the lower elevations. Its productivity for timber is higher than that

of the major habitat type. Tufted hairgrass/sedges is near bogs. Its productivity for forage is higher than that of the major habitat type.

Geology

These soils are underlain by glacial drift weathered from limestone, sandstone, and shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 0 to 35 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a somewhat dark surface layer, whereas soils that formed under meadows have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are forested areas. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Argic Cryoborolls are in meadows. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are fine-loamy, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. They are more susceptible to erosion than the dominant soils. The Cryaquolls are near bogs and in wet meadows. They are poorly drained, are fine textured, and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production in forested areas is 32 to 50 cubic feet per acre. Timber productivity in the map unit is limited by the mountain meadows. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The material exposed on steep cutbanks during road construction tends to erode and slough and is difficult to revegetate because of the harsh climate. The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Roads should not be built in wet areas.

Range

The mountain meadows are in about 30 percent of the unit but produce more than 90 percent of the forage. The average production for the potential native plant communities in the mountain meadows is about 2,225 pounds per acre of air-dry herbage in a normal year. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest. The length of the grazing season is limited by the snow cover. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for moose, elk, and grizzly bear in summer and fall. It can provide good habitat for moose in winter in areas where subalpine fir saplings are in the forest understory. It also can provide good habitat for blue grouse. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

34-2D—Typic Cryoboralfs-Argic Cryoborolls association, moraines

This map unit is on moraines. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of lower subalpine forest and mountain meadows. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and some small lakes, ponds, seeps, springs, and bogs. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest and scattered areas of meadows. The forest understory is a sparse mat of grouse whortleberry, blue huckleberry, and heartleaf arnica. The species in the mountain meadows are bearded wheatgrass, mountain brome, timber oatgrass, and sticky geranium.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/grouse whortleberry are the major habitat types in the forested areas. Also, subalpine fir/heartleaf arnica is in this unit at the higher elevations and Douglas-fir/ninebark is at the lower elevations. These habitat types are in about 55 percent of the unit. Idaho fescue/bearded wheatgrass is the major habitat type in the mountain meadows. It is in about 30 percent of the unit. A cool, moist climate, low or moderate timber productivity, and moderate forage productivity are associated with these habitat types.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/bluejoint and tufted hairgrass/sedge are in poorly drained areas around seeps and springs. Their productivity for timber and forage is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Douglas-fir/snowberry is on south-facing slopes at the lower elevations where regeneration of the forest is limited by moisture stress.

Geology

These soils are underlain by glacial drift weathered from limestone, sandstone, and shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 20 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a light colored surface layer, whereas soils that formed under meadows have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls.

The Typic Cryoboralfs formed under forest. They have a light colored surface layer and have a 20 to 35 percent content of rock fragments in the subsoil. The similar soils have a somewhat dark surface layer or have a 35 to 50 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Typic Cryoboralfs. These dominant and similar soils make up about 55 percent of the unit.

The Argic Cryoborolls formed under meadows. They have a dark surface layer and a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a very thick, dark surface layer or have a 20 to 35 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Argic Pachic Cryoborolls and fine-loamy, mixed Argic Cryoborolls. These dominant and similar soils make up about 30 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. They are less productive than the dominant soils. The Cryaquolls are near seeps and in wet meadows. They are poorly drained, are fine textured, and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is pale brown clay loam and very gravelly clay loam about 30 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production in forested areas is

45 to 71 cubic feet per acre. Timber productivity in the map unit is limited by the mountain meadows. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water, especially in areas near the mountain meadows. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The material exposed on steep cutbanks during road construction tends to slough and erode. The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The mountain meadows are in about 30 percent of the unit but produce more than 90 percent of the forage. The average production for the potential native plant communities in the mountain meadows is about 2,225 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for elk and moose in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout; however, if erosion or landslides occur, this habitat can be damaged by sedimentation.

34-3A—Mollic Cryoboralfs, glacial drift substratum, cold

This map unit is on moraines. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, some tributary streams that cascade into the valleys from adjacent hanging valleys, and some small lakes, ponds, seeps, and bogs. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation consists of open-grown forest and dense forest of stunted subalpine fir, whitebark pine, and Engelmann spruce and a few mountain meadows. The forest understory is a sparse mat of grouse whortleberry.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir also is in this unit at the higher elevations. A cold climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/grouse whortleberry is at the lower elevations. Its productivity for timber is higher than that of the major habitat types. Idaho fescue/bearded wheatgrass is in the mountain meadows. Subalpine fir/bluejoint is in poorly drained areas around seeps and bogs. Its productivity for timber is higher than that of the major habitat type.

Geology

These soils are underlain by glacial drift weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a 35 to 50 percent content of rock fragments in the subsoil and have a somewhat dark surface layer. The similar soils have a 10 to 35 percent content of rock fragments in the subsoil or have a lighter colored surface layer. They are fine-loamy, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. They have a subsoil of very cobbly sandy loam. Their productivity for timber is lower than that of

the dominant soils. The Cryaquolls are near seeps. They are poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 16 to 50 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain.

Roads

The material exposed on steep cutbanks during road construction tends to slough. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of the harsh climate. Roads should not be built in wet areas.

Range

Because the forage is in widely scattered areas, access to it is limited. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for moose, elk, and grizzly bear in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

34-3B—Mollic Cryoboralfs, glacial drift substratum

This map unit is on moraines. Elevation ranges from 7,200 to 8,000 feet. The vegetation is lower subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and small lakes, ponds, seeps, and bogs. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The understory is a thick mat of grouse whortleberry, blue huckleberry, and twinflower.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir/twinflower is on north-facing slopes. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/Sitka alder and subalpine fir/bluejoint are on moist or wet soils in draws, along streams, and near seeps. Their productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations where regeneration of the forest is limited by the climate. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by glacial drift weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. Their productivity for timber is lower than that of the dominant soils. The Cryaquolls are near seeps. They are poorly drained, are fine textured, and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

The material exposed on steep cutbanks during road construction tends to slough. Unsurfaced roads are slick when wet. Roads should not be built in wet areas.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk and moose in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout; however, if erosion occurs, this habitat can be damaged by sedimentation.

34-4B—Typic Cryoboralfs, glacial drift substratum

This map unit is on moraines. Elevation ranges from 7,000 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and some small lakes, ponds, and bogs. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest and scattered areas of mountain meadows. The forest understory is a thick mat of grouse whortleberry and blue huckleberry with some twinflower.

Habitat Types

Subalpine fir/grouse whortleberry, subalpine fir/blue huckleberry, and subalpine fir/twinflower are the major habitat types. Subalpine fir/twinflower is on cool, moist aspects. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Idaho fescue/bearded wheatgrass is in the mountain meadows. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Subalpine fir and spruce habitat types are associated with the wet soils adjacent to lakes, ponds, and bogs. Their productivity for timber is higher than that of the major habitat types.

Geology

These soils are underlain by glacial drift weathered from sandstone, shale, and volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs. They have a light colored surface layer and a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a dark surface layer or a 20 to 35 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Mollic Cryoboralfs and fine-loamy, mixed Typic Cryoboralfs. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are Aquic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls. The Aquic Cryoboralfs are near seeps and in depressions. They are somewhat poorly drained and have low strength. The Argic Cryoborolls have a dark surface layer and are in meadows.

Representative Profile of the Soils

The dominant soils have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 29

inches thick. The lower part is about 13 inches of pale brown very stony loam and very stony clay loam. The substratum to a depth of 60 inches or more is very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

The material exposed on steep cutbanks during road construction tends to slough. Unsurfaced roads are slick when wet.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. Streams within the unit normally provide habitat for trout; however, if erosion occurs, this habitat can be damaged by sedimentation.

34-4C—Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum

This map unit is on moraines. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of mountain shrubland. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are hummocky deposits of glacial drift on the bottom of U-shaped valleys and basins. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, and gently sloping flood plains and terraces, which are along the larger streams at the lower elevations. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is mountain shrubland and scattered areas of Douglas-fir forest or subalpine fir forest on north-facing slopes and in swales. The mountain shrubland has a dense canopy of big sagebrush and an understory of Idaho fescue and bluebunch wheatgrass. Douglas-fir seedlings invade the mountain shrubland in places.

Habitat Types

Big sagebrush/Idaho fescue is the major habitat type. Idaho fescue/bluebunch wheatgrass also is in this unit. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Douglas-fir and subalpine fir habitat types are on north-facing slopes and in swales. Douglas-fir/snowberry is in about 50 percent of the delineations in the Mill Creek area of the Absaroka Mountains.

Geology

These soils are underlain by glacial drift weathered from sandstone, shale, and volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rounded rock fragments in the subsoil ranges from 0 to 35 percent. Soil properties vary depending on the topography. Soils that have a moderately thick, dark surface layer are on steep slopes and ridges, whereas soils that have a very thick, dark surface layer are in depressions and on toe slopes and benches.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Argic Pachic Cryoborolls.

The Argic Cryoborolls are on steep slopes and ridges. They have a moderately fine textured subsoil. The similar soils have a fine textured subsoil. They are fine, mixed Argic Cryoborolls. These dominant and similar soils make up about 40 percent of the unit.

The Argic Pachic Cryoborolls are in depressions and on toe slopes and benches. They have a moderately fine textured subsoil. The similar soils have a fine textured subsoil. They are fine, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 40 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 20 percent of the unit. They are fine-loamy, mixed Typic Cryoboralfs or loamy-skeletal, mixed Typic Cryoboralfs. They formed under forest vegetation. They have a light colored surface layer or have a 35 to 50 percent content of rock fragments in the subsoil.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

The Argic Pachic Cryoborolls have a surface layer of grayish brown silt loam about 9 inches thick. The subsoil is brown clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is brown and yellowish brown clay loam and loam.

Management

Timber

Most of the delineations of this map unit contain only scattered stands of trees and are poorly suited to woodland managed for timber. Delineations in the Mill Creek area of the Absaroka Range contain more stands of trees and are better suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,820 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for mule deer year round and for elk in fall. In places it can provide good habitat for elk in winter.

35-1A—Dystric Cryochrepts-Rock outcrop complex, cold, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are on the lower sides and bottom of U-shaped valleys. Avalanches frequently occur in this map unit. Included in the unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and small lakes, ponds, and bogs on the bottom of valleys. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dominantly open-grown forest or dense forest of stunted whitebark pine, subalpine fir, and Engelmann spruce. Some dense lodgepole pine forest is at the lower elevations of this unit. The forest understory is a sparse mat of grouse whortleberry and heartleaf arnica.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir also is in this unit. A cold climate and low timber productivity are associated with these habitat types. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/grouse whortleberry, subalpine fir/ blue huckleberry, and subalpine fir/heartleaf arnica are at the lower elevations. Their productivity for timber is higher than that of the major habitat type.

Geology

This map unit dominantly is underlain by glacial drift weathered from granitic rocks. It is underlain by mica schist in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subrounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Dystric Cryochrepts. They have a light colored surface layer and do not have an accumulation of clay in the subsoil. The similar soils have a dark surface layer or an accumulation of clay in the subsoil. They are loamy-skeletal, mixed Typic Cryumbrepts and loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 70 percent of the unit.

The Rock outcrop is on the upper slopes. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Mollic Cryoboralfs and Argic Cryaquolls. The Mollic Cryoboralfs are underlain by mica schist. They have a moderately fine textured subsoil. Their productivity for timber is higher than that of the dominant soils. The Argic Cryaquolls are near

lakes, ponds, and bogs. They are poorly drained and have low strength.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray very gravelly loam about 4 inches thick. The subsoil is light brownish gray very cobbly loam about 8 inches thick. The substratum to a depth of 60 inches or more is light gray and white very cobbly loam.

Management

Timber

The potential annual production ranges from 16 to 32 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain.

Roads

The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of the harsh climate and moisture stress. Avalanches can increase the cost of maintaining the roads.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose when the trees in the stands are pole or sapling size. The major streams in the unit provide habitat for trout.

35-1B—Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of mountain shrubland. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are on the lower sides and bottom of U-shaped valleys. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, and gently sloping flood plains and terraces, which are along the larger streams at the lower elevations. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

A few scattered areas of open-grown Douglas-fir and limber pine are in the mountain shrubland. The mountain shrubland has a variably dense canopy of low sagebrush and an understory of bunchgrass, bluebunch wheatgrass, and Idaho fescue. Douglas-fir seedlings invade the mountain shrubland in places.

Habitat Types

Low sagebrush/Idaho fescue is the major habitat type. Douglas-fir and limber pine habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and low forage productivity are associated with these habitat types in this unit. These habitat types are in about 90 percent of the unit.

Douglas-fir/snowberry, which is a dissimilar habitat type, is in about 5 percent of the unit. It is in forested areas along the boundaries of the delineation.

Geology

These soils are underlain by glacial drift weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 60 percent. Soil properties vary depending on the topography. Soils on mounds and ridges have a dark surface layer that is thinner than that of soils in depressions.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Argic Cryoborolls and loamy-skeletal, mixed Argic Pachic Cryoborolls.

The Argic Cryoborolls are on mounds and ridges. They make up about 60 percent of the unit.

The Argic Pachic Cryoborolls are in depressions. They make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryoborolls and loamy-skeletal, mixed Pachic Cryoborolls. They do not have an accumulation of clay in the subsoil. Their productivity for timber is higher than that of the dominant soils. The dissimilar soils and the rock outcrop are in areas throughout the unit.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is pale brown very gravelly sandy clay loam about 30 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly sandy loam.

The Argic Pachic Cryoborolls have a surface layer of brown gravelly loam about 12 inches thick. The subsoil is brown very gravelly loam about 6 inches thick. The substratum to a depth of 60 inches or more is brown, yellowish brown, and light yellowish brown very cobbly sandy loam and very stony sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to ravel and erode.

Range

The average production for the potential native plant communities is about 800 pounds per acre of air-dry herbage in a normal year. The soils in swales and depressions have higher productivity than those in the higher areas. The slope and insufficient water for livestock are moderate limitations affecting range. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from the water help to overcome these limitations.

Wildlife and fisheries

This map unit can provide good habitat for elk in fall and winter, for bighorn sheep in winter, for grizzly bear in spring, and for mule deer year round. It also can provide good habitat for blue grouse in spring and summer.

35-1C—Typic Cryochrepts, glacial drift substratum, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are on the lower sides and bottom of U-shaped valleys. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and small lakes, ponds, and bogs on the bottom of valleys. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a thick mat of grouse whortleberry, blue huckleberry, and twinflower.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/ blue huckleberry are the major habitat types. Subalpine fir/twinflower is on north-facing slopes. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/Sitka alder and subalpine fir/ bluejoint are along small lakes, ponds, and bogs. Their productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by glacial drift weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subrounded rock fragments in the subsoil ranges from 25 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They have a 35 to 60 percent content of rock fragments in the subsoil. The similar soils have a 25 to 35 percent content of rock fragments in the subsoil. They are coarse-loamy, mixed Typic Cryochrepts. The dominant and similar soils make up about 85 percent of the unit.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are Argiaquic Cryoborolls and Aquic Cryoboralfs. They are in depressions and near small lakes, ponds, and bogs. They are somewhat poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches

thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 33 to 63 cubic feet per acre. The slope limits the operation of tractors. Regeneration of the forest is limited by moisture stress.

Roads

The material exposed on steep cutbanks during road construction tends to erode and ravel.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory forage following timber harvest.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

35-2C—Mollic Cryoboralfs-Argic Cryoborolls association, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of lower subalpine forest and mountain meadows. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are on the lower sides and bottom of U-shaped valleys. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and small lakes, ponds, and bogs on the bottom of valleys. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation in the forested areas is dominantly lodgepole pine. The understory is a thick mat of grouse whortleberry and blue huckleberry. The vegetation in the mountain meadows includes bearded wheatgrass, mountain brome, timber oatgrass, and many forbs.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/ blue huckleberry are the major habitat types in forested areas. The subalpine fir/heartleaf arnica, subalpine fir/ pinegrass, and subalpine fir/virginsbower habitat types also are in this unit. These habitat types are in about 55 percent of the unit. Idaho fescue/bearded wheatgrass is the major habitat type in the mountain meadows. This habitat type is in about 20 percent of the unit. A cool, moist climate and moderate timber and forage productivity are associated with these habitat types in this unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/Sitka alder is in moist areas in depressions or around small lakes, ponds, and bogs. Its productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by glacial drift weathered from limestone, sandstone, and shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 20 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a somewhat dark surface layer, whereas soils that formed under meadows have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in the forested areas. They have a somewhat dark surface layer and a 20 to 35 percent content of rock fragments in the subsoil. The similar soils have a light colored surface layer or have a 35 to 50 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Typic Cryoboralfs and loamy-skeletal, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Argic Cryoborolls are in the meadows. They have a dark surface layer and a 20 to 35 percent content of rock fragments in the subsoil. The similar soils have a very thick, dark surface layer or have a 35 to 50 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15

percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. Their productivity for timber is lower than that of the dominant soils. The Cryaquolls are in wet meadows or near small lakes, ponds, or bogs. They are poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray silt loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part to a depth of 60 inches or more is light yellowish brown and pale brown sandy clay loam and gravelly clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production in forested areas is 57 to 67 cubic feet per acre. Timber productivity in the map unit is limited by the mountain meadows. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built.

Range

The mountain meadows are in about 20 percent of the unit but produce more than 90 percent of the forage. Because the forage is in widely scattered areas, however, access to it is limited. The average production for the potential native plant communities in the mountain meadows is about 2,225 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range. Because of the slope, access to forage is moderately limited in the forested areas. The soils in the mountain meadows have low strength when they are wet. Delaying grazing until the soils have dried out helps to prevent the damage caused by trampling.

Wildlife and fisheries

This map unit can provide good habitat for elk, moose, and grizzly bear in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

35-3A—Mollic Cryoboralfs-Rock outcrop complex, cold

This map unit is on glaciated mountain slopes. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest and mountain meadows. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are on the lower sides and bottom of U-shaped valleys. Included in this unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and small lakes, ponds, and bogs on the bottom of valleys. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation in the forested areas is an open-grown forest or dense forest of stunted whitebark pine, subalpine fir, and Engelmann spruce. The forest understory is a mat of grouse whortleberry and heartleaf arnica. The vegetation in the mountain meadows includes tufted hairgrass, Idaho fescue, and sedges.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type in forested areas. Whitebark pine/subalpine fir also is in the forested areas. These habitat types are in about 60 percent of the unit. Idaho fescue/tufted hairgrass is the major habitat type in the mountain meadows. This habitat type is in about 15 percent of the unit. A cold climate, low timber productivity, and high forage productivity are associated with these habitat types in this unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/blue huckleberry and subalpine

fir/grouse whortleberry are at the lower elevations. Subalpine fir/heartleaf arnica is in scattered areas throughout the subalpine fir/whitebark pine/grouse whortleberry habitat type. The productivity of dissimilar habitat types for timber is higher than that of the major habitat types.

Geology

This map unit is underlain by glacial drift weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 10 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a somewhat dark surface layer and a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a lighter colored surface layer or have a 10 to 35 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Typic Cryoboralfs and fine-loamy, mixed Mollic Cryoboralfs. The dominant and similar soils make up about 75 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryochrepts and fine-loamy, mixed Argic Cryoborolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. Their productivity for timber is lower than that of the dominant soils. The Argic Cryoborolls have a dark surface layer. They are in the meadows.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production in forested areas is 16 to 50 cubic feet per acre. Timber productivity in the map unit is limited by the mountain meadows and the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The slope increases the amount of material excavated during road construction. The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of the harsh climate.

Range

The mountain meadows are in about 15 percent of the unit but produce more than 90 percent of the available forage. Because the forage is in widely scattered areas and because of the slope, however, access to the forage is limited. The average production for the potential native plant communities in the mountain meadows is about 1,360 pounds per acre of air-dry herbage in a normal year. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for elk, moose, and grizzly bear in summer and fall. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

35-3B—Mollic Cryoboralfs, glacial drift substratum, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 7,200 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are hummocky deposits of glacial drift on the lower sides and bottom of U-shaped valleys. Avalanches occasionally occur in this unit. Included in the unit are alluvial fans, which are in areas where tributary streams enter the valleys, gently sloping flood plains and terraces, which are along the larger streams at the lower elevations, and small lakes, ponds, and bogs on the bottom of valleys. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a thick mat of grouse whortleberry, blue huckleberry, and twinflower.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/ blue huckleberry are the major habitat types. Subalpine fir/twinflower is on north-facing slopes. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/Sitka alder and subalpine fir/ bluejoint are along streams and near small lakes, ponds, and bogs. Their productivity for timber is higher than that of the major habitat types. Subalpine fir/ whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by glacial drift weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of subrounded rock fragments in the subsoil ranges from 10 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a somewhat dark surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. The similar soils have a light colored surface layer or a 10 to 35 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Typic Cryoboralfs or fine-loamy, mixed Mollic Cryoboralfs. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts formed in moderately coarse textured glacial drift. Their productivity for timber is lower than that of the dominant soils. The Cryaquolls are near lakes, ponds, and bogs. They are poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 49 to 81 cubic feet per acre. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to slough. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are slick when wet.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range. Because of the slope, access to forage is moderately limited.

Wildlife and fisheries

This map unit can provide good habitat for elk and moose in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout; however, if erosion occurs, this habitat can be damaged by sedimentation.

35-4C—Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum, moist, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of mountain shrubland. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 45 to 70 percent. The glaciated mountain slopes are hummocky deposits of glacial drift on the lower sides and bottom of U-shaped valleys. Included in this unit are alluvial fans,

which are in areas where tributary streams enter the valleys, and gently sloping flood plains and terraces, which are along the larger streams at the lower elevations. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is open-grown forest or dense stands of big sagebrush. The understory is dominated by Idaho fescue and bluebunch wheatgrass. Douglas-fir seedlings invade the mountain shrubland in places. Scattered areas of dense forest are on north-facing slopes.

Habitat Types

Big sagebrush/Idaho fescue is the major habitat type. Idaho fescue/bluebunch wheatgrass and Douglas-fir habitat types also are in this unit. They have an understory of bunchgrass. A warm climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Douglas-fir/snowberry and subalpine fir/blue huckleberry are on the north-facing slopes of dense forest. Dense Douglas-fir forest is in about 50 percent of the delineations in the Mill Creek area of the Absaroka Range.

Geology

These soils are underlain by glacial drift weathered from interbedded sandstone and shale and some volcanic rock.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rounded rock fragments in the subsoil ranges from 0 to 25 percent. Soil properties vary depending on the topography. Soils that have a moderately thick, dark surface layer are on the steeper slopes and ridges, whereas soils that have a very thick, dark surface layer are in depressions and on toe slopes and benches.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Argic Pachic Cryoborolls.

The Argic Cryoborolls are on the steeper slopes and ridges. They have a moderately fine textured subsoil. The similar soils have a fine textured subsoil. They are fine, mixed Argic Cryoborolls. These dominant and similar soils make up about 50 percent of the unit.

The Argic Pachic Cryoborolls are on toe slopes and benches. They have a moderately fine textured subsoil. The similar soils have a fine textured subsoil. They are fine, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 30 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are fine-loamy, mixed Typic Cryoboralfs. They have a light colored surface layer. They are in areas of dense forest. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

The dominant Argic Pachic Cryoborolls have a surface layer of grayish brown silt loam about 9 inches thick. The subsoil is brown clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is yellowish brown loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber. Delineations in the Mill Creek area of the Absaroka Range contain more stands of trees and are better suited to woodland managed for timber.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,820 pounds per acre of air-dry herbage in a normal year. The slope and insufficient water for livestock are moderate limitations affecting range. Building drift fences, herding, and locating salting facilities away from the water help to overcome these limitations. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The densely forested areas produce some forage and are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk in fall and winter and for mule deer year round.

46-1B—Typic Argiborolls and Aridic Argiborolls, moderately coarse textured substratum

This map unit is on terraces. Elevation ranges from 5,200 to 6,400 feet. The vegetation consists of mountain shrubland. The soils formed in glacial outwash and alluvial deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The terraces are in large valley bottoms adjacent to major streams and rivers. Old, braided stream courses may be in areas of the larger terraces. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation dominantly is sparse to dense stands of big sagebrush that have a grassy understory. The height of the sagebrush dominantly ranges from 15 to 24 inches, but in a few areas it is more than 30 inches. The understory is dominated by bluebunch wheatgrass, junegrass, and green needlegrass. Douglas-fir seedlings invade the mountain shrubland in some places. Scattered areas of open-grown Douglas-fir forest are in other places.

Habitat Types

Big sagebrush/bluebunch wheatgrass is the major habitat type. Douglas-fir and limber pine habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and low or moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are in abandoned stream courses at the higher elevations. Their productivity for forage is higher than that of the major habitat types.

Geology

These soils are underlain by glacial outwash and alluvial deposits weathered from granitic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 65 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Argiborolls and loamy-skeletal, mixed Aridic Argiborolls.

The Typic Argiborolls are in areas where the average annual precipitation is more than 10 inches.

The Aridic Argiborolls are in areas where the average annual precipitation is about 10 inches.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Pachic Argiborolls and loamy-skeletal, mixed Typic Haploborolls. The Pachic Argiborolls are in swales, along old drainageways, and in alluvial deposits. They have a thicker surface layer than that of the dominant soils and their productivity for forage is higher. The Typic Haploborolls are on benches. They have a gravelly surface layer. They do not have an accumulation of clay in the subsoil. Their productivity for forage is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

The Aridic Argiborolls have a surface layer of brown loam about 9 inches thick. The subsoil is pale brown very gravelly loam about 17 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The average production for the potential native plant communities is about 800 to 1,500 pounds per acre of air-dry herbage in a normal year. Productivity is highest in the western half of the survey area where the average annual precipitation is highest. In places controlling the sagebrush improves production of desirable forage plants and access to forage.

Insufficient water for livestock limits the distribution of livestock.

Wildlife and fisheries

This map unit can provide good habitat for mule deer and elk in winter and for blue grouse in spring. It also can provide habitat for grizzly bear in spring in the eastern half of the survey area. The major streams in the unit provide habitat for trout; however, if erosion occurs, this habitat can be damaged by sedimentation.

46-2A—Typic Argiborolls and Aridic Argiborolls, medium and moderately fine textured substratum

This map unit is on terraces. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in glacial outwash and alluvial deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The terraces are in large valley bottoms adjacent to major streams and rivers. Old, braided stream courses may be in areas of the larger terraces. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation in the mountain grassland includes Idaho fescue, bluebunch wheatgrass, junegrass, and western needlegrass. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue. Scattered areas of Douglas-fir forest or limber pine forest are in this map unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types. Douglas-fir and limber pine habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Douglas-fir and subalpine fir habitat types are in densely forested areas. They have a shrubby understory. Idaho fescue/bearded wheatgrass is in moist areas near the old, braided stream courses. Its productivity for forage is higher than that of the major habitat types.

Geology

These soils are underlain by glacial outwash and alluvial deposits weathered from sandstone, limestone, and shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rounded and subrounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Argiborolls and loamy-skeletal, mixed Aridic Argiborolls.

The Typic Argiborolls are in areas where the average annual precipitation is more than 10 inches.

The Aridic Argiborolls are in areas where the average annual precipitation is less than 10 inches.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Dissimilar soils make up about 25 percent of the unit. They are fine-loamy, mixed Aquic Argiborolls; loamy-skeletal, mixed, frigid Typic Ustochrepts; and loamy-skeletal, mixed Mollic Eutroboralfs. The Aquic Argiborolls are in the old, braided stream courses. They are somewhat poorly drained or have a thick, dark surface layer. Their productivity for forage is higher than that of the dominant soils. The Typic Ustochrepts and Mollic Eutroboralfs are in areas of dense forest.

Representative Profile of the Soils

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

The Aridic Argiborolls have a surface layer of brown loam about 9 inches thick. The subsoil is pale brown very gravelly loam about 17 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to slough. Unsurfaced roads are slick when wet.

Range

The average production for the potential native plant communities is about 1,330 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. In places controlling the sagebrush improves the production of desirable forage plants and the access to forage. Insufficient water for livestock limits the distribution of livestock.

Wildlife and fisheries

This map unit can provide good habitat for elk and mule deer in winter and for grizzly bear in spring. It also can provide good range for elk in winter at the lower elevations. It provides good habitat for blue grouse in spring. The major streams in the unit generally provide habitat for trout; however, if erosion occurs, this habitat can be damaged by sedimentation.

46-3A—Typic Cryochrepts, obsidian sand substratum

This map unit is on terraces. Elevation ranges from 6,600 to 7,000 feet. The vegetation consists of dense lodgepole pine forest. The soils formed in glacial outwash and alluvial deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The terraces are in large valley bottoms above the streams and rivers. Dry, braided stream courses may be in areas of the larger terraces. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is lodgepole pine forest and scattered areas of mountain meadows. All age classes of lodgepole pine are in the stands. The forest understory is bitterbrush, pinegrass, and Idaho fescue.

Habitat Types

Lodgepole pine/bitterbrush is the major habitat type. A cool climate, droughty soils, and low timber productivity are associated with this habitat type in this unit. This habitat type is in about 80 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/grouse whortleberry is in areas of the finer textured soils. Its productivity for timber is higher than that of the major habitat type. Idaho fescue/bluebunch wheatgrass is in the mountain meadows.

Geology

These soils are underlain by glacial outwash and alluvial deposits weathered from obsidian and rhyolite. These deposits are coarse textured and contain rounded pebbles and cobbles. The surface is mantled by a thin layer of silty loess in places.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are sandy-skeletal, siliceous Typic Cryochrepts. They have an accumulation of clay in the subsoil. The similar soils do not have an accumulation of clay in the subsoil. They are sandy-skeletal, siliceous Typic Cryorthents. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryorthents. They formed in medium textured alluvial deposits. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of pale brown coarse sandy loam about 5 inches thick. The subsoil is pale brown very gravelly coarse sandy loam about 7 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly loamy coarse sand and very gravelly coarse sand.

Management

Timber

The potential annual production ranges from 23 to 45 cubic feet per acre. Regeneration of the forest is limited by moisture stress. Soil productivity is dependent on the finer textured surface layer since the subsoil is droughty and infertile. Operating equipment can reduce productivity because the surface layer is redistributed.

Roads

This map unit is suitable as a site for roads that are properly located, constructed, and maintained.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. Grizzly bears are frequently in areas of the unit because of its proximity to suitable habitat.

53-1A—Typic Cryoborolls-Argic Cryoborolls-Rock outcrop association, south aspect

This map unit is on mountain slopes. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain slopes are convex and have narrow ridgetops. Seeps and springs are in drainageways and on toe slopes. Some old deposits from landslides are in the drainageways. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, and western needlegrass. The mountain shrubland has a canopy of big sagebrush and an understory generally dominated by Idaho fescue. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in the understory in moist areas. Scattered areas of open-grown Douglas-fir forest are in this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types. Limber pine and Douglas-fir habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 60 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Idaho fescue/bearded wheatgrass is in areas of the deeper soils and in moist areas. Its productivity for forage is higher than that of the major habitat types. Douglas-fir and subalpine fir habitat types are in densely forested areas. They have an understory of shrubs.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by sandstone, rhyolite, or diorite in places.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured or medium textured surface layer. The content of subangular rock fragments in the subsoil ranges from 35 to 60 percent. Soil properties vary depending on the topography. Soils on the steeper side slopes do not have an accumulation of clay in the subsoil, whereas soils on benches and in swales have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoborolls and loamy-skeletal, mixed Argic Cryoborolls.

The Typic Cryoborolls are on the steeper side slopes. They make up about 50 percent of the unit.

The Argic Cryoborolls are along drainageways and on toe slopes. They have a dark surface layer. The similar soils have a thicker or thinner, dark surface layer. They are loamy-skeletal, mixed Argic Pachic Cryoborolls and loamy-skeletal, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 25 percent of the unit.

The Rock outcrop is on ridgetops. It makes up about 15 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryochrepts. They are near ridgetops. They have a thin, dark surface layer. Their productivity for forage is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Cryoborolls have a surface layer of dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is dark grayish brown very gravelly sandy loam about 9 inches thick. The lower part is dark grayish brown very cobbly sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly sandy loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown sandy clay loam grading to very gravelly sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Hard rock limits excavation in places. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The average production for the potential native plant communities is about 1,330 pounds per acre of air-dry herbage in a normal year. In places controlling the sagebrush improves production of desirable forage plants and access to forage. Insufficient water for livestock limits livestock distribution.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer, fall, and winter, for elk in fall and winter, and for grizzly bear in spring. It also can provide good habitat for blue grouse in spring and good nesting habitat for raptors that nest on cliffs. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

53-1D—Typic Cryochrepts, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 6,100 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain slopes are convex and have narrow ridgetops. Seeps and springs are in drainageways and on toe slopes. Some old deposits from landslides are in the drainageways. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a dense mat of blue huckleberry, grouse whortleberry, twinflower, and pinegrass.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/twinflower are the major habitat types. Subalpine fir/pinegrass is on south-facing slopes. Subalpine fir/grouse whortleberry also is in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. Subalpine fir/Sitka alder is in the drainageways or near the seeps. It is associated with seasonally wet soils and moderate timber productivity in this unit. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Douglas-fir habitat types are on the lower, south-facing slopes, and subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils dominantly are underlain by coarse grained rocks, such as granite or gneiss. They are underlain by sandstone, rhyolite, and diorite in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subangular rock fragments in the subsoil ranges from 35 to 65 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They have a light colored surface layer. They make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Aquic Cryoboralfs. They are in drainageways and on toe slopes. The Typic Cryoboralfs have a finer textured subsoil than the dominant soils. Their productivity for timber is higher than that of the dominant soils. The Aquic Cryoboralfs have a fluctuating water table. Landslides are associated with these soils. The rock outcrop is on ridgetops.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely cobbly sandy loam.

Management

Timber

The potential annual production ranges from 53 to 69 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

This map unit is suitable as a site for roads that are properly located, constructed, and maintained. Roads should not be built in wet areas.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide fair or good habitat for elk and moose in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The streams in the unit generally provide habitat for trout;

however, if erosion occurs, this habitat can be damaged by sedimentation.

53-3A—Argic Cryoborolls-Argic Pachic Cryoborolls association, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,400 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain slopes are convex and have narrow ridgetops. Some old deposits from landslides are in drainageways. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain shrubland has a canopy of big sagebrush and an understory generally dominated by Idaho fescue and forbs. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in the understory in moist areas. The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and common forbs. Open-grown or dense stands of limber pine, Douglas-fir, and lodgepole pine are in this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Big sagebrush/Idaho fescue and Idaho fescue/ bluebunch wheatgrass are the major habitat types. Douglas-fir and limber pine habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Idaho fescue/bearded wheatgrass is in areas of the deeper soils and on concave slopes that receive runoff from the higher lying soils. Its productivity for forage is higher than that of the major habitat types. Subalpine fir and Douglas-fir habitat types are in the dense stands of trees. They have an understory of shrubs.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. Bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and a 35 to 50 percent content of rock fragments in the subsoil. Soil properties vary depending on the topography. Soils that have a moderately thick, dark surface layer are on convex slopes, benches, and ridgetops, whereas soils that have a very thick, dark surface layer are in swales, small valleys, and draws.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Argic Cryoborolls and loamy-skeletal, mixed Argic Pachic Cryoborolls.

The Argic Cryoborolls are on convex slopes, benches, and ridgetops. They make up about 55 percent of the unit.

The Argic Pachic Cryoborolls are in swales, small valleys, and draws. They make up about 30 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Lithic Cryochrepts. They are near areas of rock outcrop. They are shallow and are moderately coarse textured. Their productivity for timber and forage is lower than that of the dominant soils. The rock outcrop is on ridgetops and the upper slopes.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam grading to very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

The Argic Pachic Cryoborolls have a surface layer of brown gravelly loam about 12 inches thick. The subsoil is brown very gravelly silty clay loam about 6 inches thick. The substratum to a depth of 50 inches or more is brown, yellowish brown, and light yellowish brown very cobbly sandy loam and very stony sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

This map unit is suitable as a site for roads that are properly located, constructed, and maintained. Unsurfaced roads are slick when wet.

Range

The average production for the potential native plant communities is about 1,988 pounds per acre of air-dry

herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. Insufficient water for livestock is a limitation. Controlling the sagebrush improves production of desirable forage plants and access to forage.

Wildlife and fisheries

This map unit can provide good habitat for mule deer and elk in fall and winter and for grizzly bear in spring. It also can provide good habitat for blue grouse in spring and summer and good nesting habitat for raptors that nest on cliffs.

53-3B—Mollic Cryoboralfs-Argic Cryoborolls association, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,800 feet. The vegetation consists of lower subalpine forest and dense Douglas-fir forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain slopes are convex and have narrow ridgetops. Seeps and springs are in some areas. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation on north-facing slopes is dense lodgepole pine forest and that on south-facing slopes is open-grown forest and dense Douglas-fir forest. On north-facing slopes the forest understory is dominated by shrubs. On south-facing slopes it is dominated by shrubs or by grasses.

Habitat Types

Subalpine fir/grouse whortleberry, subalpine fir/blue huckleberry, and subalpine fir/twinflower are the major habitat types on north-facing slopes. Subalpine fir/pinegrass and Douglas-fir habitat types also are on north-facing slopes. They have a shrubby understory. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 40 percent of the unit. Douglas-fir/snowberry is on south-facing slopes. A warm, moist climate and low timber productivity are associated with this habitat type in this unit. This habitat type is in about 40 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/sweetscented bedstraw is in moist areas. Its productivity for timber is higher than that of the major habitat types. Douglas-fir habitat types are on south-facing slopes. They have an understory of bunchgrass. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. This bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 10 to 35 percent. Soil properties vary depending on the vegetation. Soils that formed under dense forest have a somewhat dark surface layer, whereas soils that formed under open-grown forest have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in areas of dense forest. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Argic Cryoborolls are in areas of open-grown forest. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are fine-loamy, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine-loamy, mixed Aquic Cryoboralfs or Cryaquolls. They are near seeps or in depressions on north-facing slopes. They are somewhat poorly drained and have low strength. Their productivity for timber is higher than that of the similar soils. The rock outcrop is on ridgetops and the upper slopes.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about

22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 54 to 90 cubic feet per acre on north-facing slopes and from 13 to 41 cubic feet per acre on south-facing slopes. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by moisture stress and plant competition on south-facing slopes. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory produces a limited amount of forage. Forage production increases after timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall and for elk in fall. It also can provide good habitat for blue grouse in fall. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

53-3C—Mollic Cryoboralfs, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 10 to 45 percent. The mountain slopes are convex and have narrow ridgetops. Seeps and springs are in places. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a dense mat of grouse whortleberry, twinflower, and blue huckleberry.

Habitat Types

Subalpine fir/twinflower and subalpine fir/grouse whortleberry are the major habitat types. Subalpine fir/ blue huckleberry also is in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/Sitka alder and subalpine fir/ bluejoint are in wet draws and near seeps. They are associated with a cool, wet climate. Their productivity for timber is higher than that of the major habitat types. Douglas-fir/snowberry is at the lower elevations. It is associated with a warm climate. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils dominantly are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. This bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly. The soils are underlain by granitic rocks in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 10 to 35 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts; fine-loamy, mixed, Argic Pachic Cryoborolls; fine-loamy, mixed Aquic Cryoboralfs; and Cryaquolls. The Typic Cryochrepts are underlain by granitic rocks. They are moderately coarse textured. Their productivity for timber is lower than that of the dominant soils. The Argic Pachic Cryoborolls, Aquic Cryoboralfs, and Cryaquolls are in depressions and near seeps. They are moderately well drained, somewhat poorly drained, or poorly drained and have low strength. Their productivity for timber is higher than that of the dominant soils. The rock outcrop is on ridgetops and the upper slopes.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam

about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory produces a limited amount of forage. Forage production increases after timber harvest. The forested areas are well suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk in summer and fall and for moose in fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings occur in the forest understory. It provides good security cover for mule deer, elk, and moose. The streams in the unit provide habitat for trout; however, if erosion occurs, this habitat can be damaged by sedimentation.

54-1A—Typic Haploborolls-Typic Ustochrepts-Rock outcrop complex, mountain slopes, steep

This map unit is on mountain slopes. Elevation ranges from 6,000 to 8,000 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and common forbs. The mountain shrubland is vegetated with sagebrush that has an understory dominated by Idaho fescue and forbs. Bluebunch wheatgrass and junegrass also are in this unit. Scattered areas of open-grown Douglas-fir forest are in the unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types. Douglas-fir habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and moderate forage productivity are associated with these habitat types in this map unit. These habitat types are in about 70 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Idaho fescue/bearded wheatgrass is on moist soils. Its productivity for forage is higher than that of the major habitat types. Douglas-fir/snowberry and Douglas-fir/pinegrass are in densely forested areas.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by sandstone, rhyolite, or diorite in places.

Characteristics of the Soils

The soils in this map unit have a medium textured or moderately coarse textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the topography. Soils that are on the lower slopes have a dark surface layer, whereas soils that are on the upper slopes near the Rock outcrop have a light colored surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Haploborolls and loamy-skeletal, mixed, frigid Typic Ustochrepts.

The Typic Haploborolls are on the lower slopes. They do not have an accumulation of clay in the subsoil. The similar soils have an accumulation of clay in the subsoil. They are loamy-skeletal, mixed Aridic Argiborolls. These dominant and similar soils make up about 45 percent of the unit.

The Typic Ustochrepts are on the upper slopes, near the Rock outcrop. They are 20 to 40 inches deep over bedrock. The similar soils are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed, frigid Lithic Ustochrepts. These dominant and similar soils make up about 30 percent of the unit.

The Rock outcrop is on the upper slopes. It makes up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 5 percent of the unit. They are loamy-skeletal, mixed Typic Eutroboralfs. They are in areas of dense forest and are medium textured. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Haploborolls have a surface layer of very gravelly loam about 14 inches thick. The upper 9 inches is dark grayish brown, and the lower 5 inches is brown. The subsoil is light yellowish brown very gravelly sandy loam about 10 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very gravelly sandy loam.

The Typic Ustochrepts have a surface layer of light brownish gray gravelly sandy loam about 6 inches thick. The upper part of the subsoil is brown very cobbly loam about 2 inches thick. The lower part is yellowish red very cobbly sandy clay loam about 11 inches thick. The substratum is light reddish brown very stony sandy loam. Granitic rock is at a depth of about 36 inches.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of moisture stress. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The average production for the potential native plant communities is about 1,330 pounds per acre of air-dry herbage in a normal year. The slope severely limits access to forage. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from water help to overcome these limitations. Erosion is a hazard on trails made by livestock. The forest understory produces a limited amount of forage. Forage production increases after timber harvest. The forested areas can be used for transitory range.

Wildlife and fisheries

This map unit can provide good habitat for bighorn sheep in winter, for mule deer in summer, fall, and winter, and for elk in fall and winter. It also can provide good habitat for blue grouse in spring and summer and good nesting habitat for raptors that nest on cliffs. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-1B—Rock outcrop-Typic Cryochrepts-Typic Cryoborolls complex, south aspect, steep

This map unit is on mountain slopes. Elevation ranges from 6,500 to 8,000 feet. The vegetation consists of open-grown forest at the lower elevations and lower subalpine forest at the higher elevations. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The vegetation at the lower elevations and on south- and west-facing slopes is mostly open-grown Douglas-fir forest. Dense lodgepole pine forest is at the higher elevations and on north- and east-facing slopes. The forest understory is dominated by grasses and low-growing shrubs. Scattered areas of mountain meadows also are in this unit.

Habitat Types

Douglas-fir habitat types are at the lower elevations and on south- and west-facing slopes. Subalpine fir habitat types are at the higher elevations and on north- and east-facing slopes. A warm, dry climate is associated with the Douglas-fir habitat types and a cool, dry climate with the subalpine fir habitat types in this unit. Low timber productivity is associated with all of the habitat types in this unit. These habitat types are in about 45 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are in the mountain meadows. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by sandstone, rhyolite, or diorite in places.

Characteristics of the Soils

The soils in this map unit have a medium textured or moderately coarse textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under subalpine forest have a light colored surface layer, whereas soils that formed under open-grown forest or under mountain meadows have a dark surface layer.

Map Unit Composition

The Rock outcrop is in areas throughout this map unit. It makes up about 40 percent of the unit.

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Typic Cryoborolls.

The Typic Cryochrepts are in areas of subalpine forest. They are moderately coarse textured. The similar soils have a coarse textured subsoil. They are sandy-skeletal, mixed Typic Cryochrepts. These dominant and similar soils make up about 35 percent of the unit.

The Typic Cryoborolls are in areas of open-grown forest or in mountain meadows. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are loamy-skeletal, mixed Pachic Cryoborolls. These dominant and similar soils make up about 25 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

The Typic Cryoborolls have a surface layer of dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is dark grayish brown very gravelly sandy loam about 9 inches thick. The lower part is dark grayish brown very cobbly sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly sandy loam.

Management

Timber

Potential annual production is 16 to 52 cubic feet per acre in the subalpine forest and 16 to 26 cubic feet per acre in the open-grown forest. Productivity in the map unit is limited by the Rock outcrop. The Rock outcrop limits the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of moisture stress. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The slope severely limits access by livestock. Building drift fences, herding, and locating salting facilities away from water help to overcome this limitation. The forest understory produces a moderate amount of forage. Productivity increases following timber harvest. Erosion is a hazard on trails made by livestock.

Wildlife and fisheries

This map unit can provide good habitat for elk in fall and for mountain goats in winter. It also can provide good habitat for blue grouse in spring and summer and good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-1C—Typic Cryochrepts-Rock outcrop complex, warm, steep

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of dense Douglas-fir forest on north-facing slopes and open-grown or dense Douglas-fir forest on south-facing slopes. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of these slopes. The landforms are not subject to landslides. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The vegetation is mostly dense or open-grown Douglas-fir forest. The forest understory is a mat of low-

growing shrubs on north- and east-facing slopes and bunchgrasses on south- and west-facing slopes.

Habitat Types

Douglas-fir/snowberry is the major habitat type on north- and east-facing slopes. Douglas-fir/ninebark also is on these slopes. These habitat types are in about 40 percent of the unit. Douglas-fir/Idaho fescue is on south- and west-facing slopes. Other Douglas-fir or limber pine habitat types also are on these slopes. They have an understory of bunchgrass. These habitat types are in about 35 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/blue huckleberry and subalpine fir/Sitka alder are at the higher elevations on north- and east-facing slopes. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by sandstone, rhyolite, diorite, or mica schist in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They have a light colored surface layer and a moderately coarse textured subsoil. The similar soils have a dark surface layer or a coarse textured subsoil. They are loamy-skeletal, mixed Typic Cryoborolls and sandy-skeletal, mixed Typic Cryochrepts. The dominant and similar soils make up about 75 percent of the unit.

The Rock outcrop is on ridgetops and the upper slopes. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryoboralfs. They are in drainageways and in areas underlain by mica schist. They are medium textured. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 36 to 48 cubic feet per acre on north- and east-facing slopes and from 16 to 26 cubic feet per acre on south- and west-facing slopes. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by plant competition on south- and west-facing slopes. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

Hard rock limits excavation in places. The material exposed on steep cutbanks during road construction tends to ravel and is difficult to revegetate because of moisture stress. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The slope severely limits access to forage. Forage production is moderate on south- and west-facing slopes and low on north- and east-facing slopes. It increases on all aspects following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-1E—Dystric Cryochrepts-Rock outcrop complex, steep

This map unit is on mountain slopes. Elevation ranges from 6,600 to 8,200 feet. The vegetation consists of upper subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of these slopes. Avalanches frequently occur in this map unit. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The vegetation is open-grown or dense whitebark

pine and subalpine fir forest and scattered, moist areas of mountain meadows. The forest understory is a mat of shrubs, forbs, and grasses dominated by grouse whortleberry, heartleaf arnica, and pinegrass.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Subalpine fir/grouse whortleberry and subalpine fir/pinegrass are at the lower elevations, and whitebark pine/subalpine fir is at the higher elevations. A cold climate and low or moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 65 percent of the unit.

Idaho fescue/tufted hairgrass, which is a dissimilar habitat type, is in about 5 percent of the unit. It is in the mountain meadows.

Geology

This map unit dominantly is underlain by coarse grained igneous rocks, such as granite, gneiss, or diorite. It is underlain by sandstone and shale or rhyolite flows in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Dystric Cryochrepts. They have a moderately coarse textured subsoil. The similar soils have a coarse textured subsoil. They are sandy-skeletal, mixed Typic Cryorthents. The dominant and similar soils make up about 60 percent of the unit.

The Rock outcrop is in areas throughout this map unit. Rubble land is a similar component in the unit. The Rock outcrop and Rubble land make up about 30 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryoboralfs. They are in drainageways or in areas underlain by sandstone and shale. They are medium textured. Their productivity for timber is higher than that of the dominant soils. Some delineations in the Crazy Mountains are entirely made up of these soils.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray very gravelly loam about 4 inches thick. The subsoil is light brownish gray very gravelly loam about 8 inches thick. The substratum is light gray and white very cobbly loam. Weathered rhyolite is at a depth of about 40 inches.

Management

Timber

The potential annual production ranges from 16 to 32 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope and the Rock outcrop limit the operation of tractors. Regeneration of the forest is limited by the harsh climate.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The slope severely limits access to forage. The forest understory produces a limited amount of forage.

Wildlife and fisheries

This map unit can provide good habitat for bighorn sheep and mountain goats in summer and fall. It provides good security cover for mule deer, elk, and moose.

54-1G—Typic Cryochrepts-Rock outcrop complex, steep

This map unit is on mountain slopes. Elevation ranges from 5,600 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The vegetation dominantly is dense stands of lodgepole pine forest. Some areas of Douglas-fir forest are at the lower elevations. The forest understory is a mat of shrubs dominated by grouse whortleberry and blue huckleberry on north-facing slopes and by pinegrass on south-facing slopes.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/ blue huckleberry are the major habitat types. Subalpine fir/pinegrass is on south-facing slopes, subalpine fir/ twinflower is on north-facing slopes at the higher elevations, and Douglas-fir/ninebark is at the lower elevations. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 60 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Subalpine fir/Sitka alder is in draws or on north-facing slopes at the higher elevations. Its productivity for timber is higher than that of the major habitat types. Subalpine fir/whitebark pine/grouse whortleberry is on ridges and slopes at the higher elevations, and Douglas-fir/snowberry is at the lower elevations and on south-facing slopes. Their productivity for timber is lower than that of the major habitat types.

Geology

This map unit dominantly is underlain by coarse grained rocks, such as granite or gneiss. It is underlain by interbedded layers of sandstone and shale, rhyolite, or diorite in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 65 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They make up about 75 percent of the unit.

The Rock outcrop is on ridgetops and near streams. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryoboralfs. They are in areas underlain by interbedded shale and sandstone. They are medium textured. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely cobbly sandy loam.

Management

Timber

The potential annual production ranges from 53 to 85 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope limits the operation of tractors.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

The slope severely limits access to forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-2B—Rock outcrop-Typic Ustochrepts-Typic Calciborolls complex, steep

This map unit is on mountain slopes. Elevation ranges from 6,000 to 7,500 feet. The vegetation consists of open-grown forest, mountain grassland, and mountain shrubland. The soils formed in material weathered from limestone and sandstone.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have moderate water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is open-grown Douglas-fir or lodgepole pine forest. The forest understory contains shrubs and bunchgrasses. Common juniper, snowberry, big sagebrush, Idaho fescue, and bluebunch wheatgrass are the dominant species. The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue and common forbs. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Douglas-fir/snowberry and Douglas-fir/Idaho fescue are the major habitat types in the forested areas. A cool, dry climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 25 percent of the unit. Big sagebrush/Idaho fescue is the major habitat type in the mountain shrubland, and Idaho fescue/bluebunch is the major habitat type in the mountain grassland. Limber pine also is in areas of the shrubland and grassland. It has an understory of bunchgrass. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 25 percent of the unit.

Subalpine fir habitat types, which are dissimilar habitat types, are in about 10 percent of the unit. They are on north-facing slopes at the higher elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit dominantly is underlain by thick beds of limestone and calcareous sandstone. It is underlain by thin beds of shale in places.

Characteristics of the Soils

The soils in this map unit have a medium textured or moderately fine textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. The subsoil is calcareous. Soil properties vary depending on the vegetation. Soils that formed under forest have a light colored surface layer, whereas soils that formed under mountain grassland and mountain shrubland have a dark surface layer.

Map Unit Composition

The Rock outcrop is in areas throughout this map unit. It makes up about 40 percent of the unit.

The dominant soils are loamy-skeletal, mixed, frigid Typic Ustochrepts and loamy-skeletal, carbonatic Typic Calciborolls.

The Typic Ustochrepts are in the forested areas. They make up about 30 percent of the unit.

The Typic Calciborolls are in areas of the mountain grassland and mountain shrubland. They have a dark surface layer and do not have an accumulation of clay in the subsoil. The similar soils have a somewhat lighter colored surface layer or an accumulation of clay in the subsoil. They are loamy-skeletal, carbonatic Aridic Calciborolls and loamy-skeletal, mixed Typic Argiborolls. These dominant and similar soils make up about 20 percent of the unit.

Representative Profile of the Soils

The Typic Ustochrepts have a surface layer of light brownish gray clay loam and gravelly clay loam. The surface layer is about 6 inches thick. The upper part of the subsoil is brown very gravelly clay loam about 2 inches thick. The lower part is yellowish red very cobbly sandy clay loam about 11 inches thick. The substratum to a depth of 60 inches or more is light reddish brown very cobbly clay loam.

The Typic Calciborolls have a surface layer of calcareous, dark grayish brown and grayish brown very gravelly silt loam and loam. The surface layer is about 20 inches thick. The subsoil is calcareous, pale brown very gravelly loam about 7 inches thick. The substratum to a depth of 60 inches or more is calcareous, very pale brown extremely cobbly sandy loam.

Management

Timber

Potential annual production in the forested areas is 16 to 48 cubic feet per acre. Timber productivity in the map unit is limited by the Rock outcrop and the mountain grassland and mountain shrubland. The slope and the Rock outcrop limit the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The average production for the potential native plant communities is about 1,250 pounds per acre of air-dry herbage in a normal year. The slope and the Rock outcrop are limitations affecting range. The forest understory produces a limited amount of forage. Forage production increases following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for blue grouse in spring and winter and good nesting habitat for raptors that nest on cliffs. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-2C—Typic Cryochrepts-Rock outcrop complex, limestone substratum, steep

This map unit is on mountain slopes. Elevation ranges from 7,000 to 8,000 feet. The vegetation

consists of lower subalpine forest. The soils formed in material weathered from limestone.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. Avalanches occasionally occur in this unit. The soils on the landforms have moderate water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is lodgepole pine forest. The forest understory is a mat of shrubs dominated by blue huckleberry and twinflower on north- and east-facing slopes and by pinegrass on south- and west-facing slopes.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/twinflower are the major habitat types on north- and east-facing slopes. Subalpine fir/pinegrass is the major habitat type on south- and west-facing slopes. Subalpine fir/heartleaf arnica and Douglas-fir/ninebark also are in this unit. A cool climate and low or moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 50 percent of the unit.

Subalpine fir/whitebark pine/grouse whortleberry, which is a dissimilar habitat type, is in about 10 percent of the unit. It is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

This map unit dominantly is underlain by thick beds of limestone. It is underlain by limey sandstone or thin beds of shale in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They have a light colored surface layer and are 20 to 40 inches deep over bedrock. The similar soils have a dark surface layer or are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed Typic Cryoborolls or loamy-skeletal, mixed Lithic Cryochrepts. The dominant and similar soils make up about 50 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 40 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryoboralfs. They are on the lower slopes or in areas underlain by shale. They are moderately fine textured. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is calcareous, very pale brown very cobbly loam about 13 inches thick. The substratum is calcareous, very pale brown very cobbly loam. Limestone bedrock is at a depth of about 32 inches.

Management

Timber

The potential annual production ranges from 33 to 63 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope and the Rock outcrop limit the operation of tractors. Regeneration is limited by moisture stress.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The slope severely limits access to forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-2D—Typic Argiborolls-Typic Ustochrepts-Rock outcrop complex, steep

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of dense Douglas-fir forest, mountain grassland, and mountain shrubland. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The slopes are unstable in more than 40 percent of the unit. Landslides occur frequently near seeps and springs. Some old deposits from landslides are in places. The soils on the landforms have little water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of sagebrush and an understory dominated by Idaho fescue and forbs. The understory in the Douglas-fir forest consists of shrubs and bunchgrasses. Common juniper, snowberry, big sagebrush, Idaho fescue, and bluebunch wheatgrass are the dominant species.

Habitat Types

Idaho fescue/bluebunch wheatgrass is the major habitat type in the mountain grassland. Big sagebrush/Idaho fescue is the major habitat type in the mountain shrubland. Limber pine habitat types also are in this unit. They have an understory of bunchgrass. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 45 percent of the unit. Douglas-fir/snowberry and Douglas-fir/Idaho fescue are the major habitat types in the forested areas. A cool, dry climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 30 percent of the unit.

Subalpine fir habitat types, which are dissimilar habitat types, are in about 10 percent of the unit. They are on north-facing slopes at the higher elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit is underlain by thick beds of light colored sandstone and multicolored shale. Shale outcrops add color to the local landscape. The sandstone forms ridges. The landslides are associated with the shale bedrock. The seeps commonly are along the contact between the sandstone and the shale.

Characteristics of the Soils

The soils in this map unit have a medium textured or moderately fine textured surface layer. The content of rock fragments in the subsoil ranges from 20 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under mountain grassland and mountain shrubland have a dark surface layer, whereas soils that formed in areas of dense Douglas-fir forest near the Rock outcrop have a light colored surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Argiborolls and loamy-skeletal, mixed, frigid Typic Ustochrepts.

The Typic Argiborolls are in areas of mountain grassland and mountain shrubland. They have a 35 to 50 percent content of rock fragments in the subsoil and are noncalcareous in the subsoil. The similar soils have a 20 to 35 percent content of rock fragments in the subsoil or are calcareous in the subsoil. They are fine-loamy, mixed Typic Argiborolls and loamy-skeletal, mixed Typic Calciborolls. These dominant and similar soils make up about 55 percent of the unit.

The Typic Ustochrepts are in areas of the dense Douglas-fir forest or near the areas of Rock outcrop. They make up about 20 percent of the unit.

The Rock outcrop is on side slopes and ridgetops and near stream courses. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Eutroboralfs. They are in areas of the dense Douglas-fir forest. They have an accumulation of clay in the subsoil. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

The Typic Ustochrepts have a surface layer of light brownish gray clay loam and gravelly clay loam. The surface layer is about 6 inches thick. The upper part of the subsoil is brown very gravelly clay loam about 2 inches thick. The lower part is yellowish red very cobbly sandy clay loam about 11 inches thick. The substratum to a depth of 60 inches or more is calcareous, light reddish brown very cobbly clay loam.

Management

Timber

Potential annual production in the forested areas is 16 to 48 cubic feet per acre. Timber productivity in the map unit is limited by the Rock outcrop and the mountain grassland and mountain shrubland. The slope affects the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of moisture stress. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities in the mountain grassland and mountain shrubland is about 1,250 pounds per acre of air-dry herbage in a normal year. The slope and insufficient water for livestock are limitations affecting range. Livestock tend to gather in the small, included areas of less sloping soils. The forest understory produces some forage. Forage production increases following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in fall and winter and for elk in winter. It also can provide good habitat for blue grouse in spring and good nesting habitat for raptors that nest on cliffs. If landslides or erosion occurs in this map unit, the sediment can damage the habitat of fish.

54-2E—Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. Avalanches occasionally occur in this unit. The landforms have a high risk of landslides. The landslides occur frequently near seeps and springs. The soils on the landforms have low water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense or open-grown lodgepole pine forest and scattered, moist areas of mountain meadows. The forest understory is a thick mat of shrubs dominated by grouse whortleberry and blue huckleberry on north-facing slopes and by pinegrass on south-facing slopes.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir/heartleaf arnica also is in this unit. Subalpine fir/pinegrass is on south-facing slopes of the unit. A cool, moist climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Idaho fescue/bearded wheatgrass is in the mountain meadows.

Geology

This map unit is underlain by thick beds of light colored sandstone and some limestone and multicolored shale. Shale outcrops add color to the local landscape. The sandstone and limestone form ridges and outcrops. The landslides are associated with the shale. The seeps commonly are along the contact between the sandstone and the shale.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 20 to 50 percent. Soil properties vary depending on the underlying bedrock. Soils underlain by shale have an accumulation of clay in the subsoil. The content of rock fragments in their subsoil ranges from 20 to 35 percent. Soils underlain by sandstone do not have an accumulation of clay in the subsoil. The content of rock fragments in their subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs are underlain by shale. They make up about 55 percent of the unit.

The Typic Cryochrepts are underlain by sandstone. They make up about 30 percent of the unit.

The Rock outcrop is on ridges and benches and along streams. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 52 to 70 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of moisture stress. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are slick when wet.

Range

The slope severely limits access to forage. The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The mountain meadows are highly productive, but they are minor in extent.

Wildlife and fisheries

This map unit can provide good habitat for blue grouse in fall. It provides good security cover for mule deer, elk, and moose. If landslides or erosion occurs in this map unit, the sediment can damage the habitat of fish.

54-3A—Typic Argiborolls-Pachic Argiborolls-Rock outcrop complex, south aspect, steep

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. Some old deposits from landslides are in places. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and common forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue and forbs. Scattered areas of open-grown Douglas-fir or limber pine forest are in this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass is the major habitat type in the mountain grassland. Big sagebrush/ Idaho fescue is the major habitat type in the mountain shrubland. Douglas-fir or limber pine habitat types also are in this unit. They have an understory of bunchgrass. A warm, somewhat moist climate, moderate forage productivity, and very low timber productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Idaho fescue/bearded wheatgrass is in moist areas. Its productivity for forage is higher than that of the major habitat types. Douglas-fir and subalpine fir habitat types are in densely forested areas. They have an understory of shrubs or forbs.

Geology

This map unit is underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs.

Bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the topography. Soils that are on ridges and slopes have a moderately thick, dark surface layer, whereas soils that are in swales, small valleys, and draws and on old landslides and toe slopes have a thick, dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Argiborolls and loamy-skeletal, mixed Pachic Argiborolls.

The Typic Argiborolls are on ridges and slopes. They make up about 55 percent of the unit.

The Pachic Argiborolls are in swales, small valleys, and draws and on old landslides and toe slopes. They make up about 20 percent of the unit.

The Rock outcrop is on ridgetops and near stream courses. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Lithic Ustochrepts. They are near areas of the Rock outcrop. They are shallow and have a light colored surface layer. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

The Pachic Argiborolls have a surface layer of dark grayish brown loam gravelly silt loam and cobbly clay loam. The surface layer is about 30 inches thick. The subsoil is brown very cobbly clay loam about 7 inches thick. The substratum to a depth of 60 inches or more is brown and pale brown very cobbly clay loam and very cobbly loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The average production for the potential native plant communities is about 1,635 pounds per acre of air-dry herbage in a normal year in the mountain grassland. It is about 1,965 pounds per acre of air-dry herbage in a normal year in the mountain shrubland. In places controlling the sagebrush improves production of desirable forage plants and access to forage. The slope limits access to forage. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from water help to overcome these limitations. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for mule deer and elk in fall and winter and for grizzly bear in spring. It also can provide good habitat for blue grouse in spring and summer and good nesting habitat for raptors that nest on cliffs. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-3C—Mollic Eutroboralfs-Typic Argiborolls-Rock outcrop complex, steep

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of dense Douglas-fir forest, mountain grassland, and mountain shrubland. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes are on south aspects. They have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

Dense Douglas-fir forest is on north- and east-facing slopes and open-grown Douglas-fir forest is on south- and west-facing slopes. Some dense lodgepole pine forest also is in this unit. The forest understory is a

sparse cover of shrubs and bunchgrasses. It is dominated by snowberry and Idaho fescue. The mountain grassland is dominated by bluebunch wheatgrass, Idaho fescue, and forbs. The mountain shrubland contains big sagebrush and an understory of bunchgrass. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Douglas-fir/snowberry is the major habitat type on north- and east-facing slopes of the forested area, and Douglas-fir/Idaho fescue is the major habitat type on south- and west-facing slopes. A cool, dry climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 50 percent of the unit. Idaho fescue/bluebunch wheatgrass and big sagebrush/bluebunch wheatgrass are the major habitat types in the mountain grassland and mountain shrubland. Moderate forage productivity is associated with these habitat types. These habitat types are in about 20 percent of the unit.

Subalpine fir habitat types, which are dissimilar habitat types, are in about 15 percent of the unit. They have an understory of shrubs or grasses and are at the higher elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit is underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. Bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a somewhat dark surface layer, whereas soils that formed under grassland have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Eutroboralfs and loamy-skeletal, mixed Typic Argiborolls.

The Mollic Eutroboralfs are in areas of the Douglas-fir forest. They make up about 60 percent of the unit.

The Typic Argiborolls are in areas of the mountain grassland and the mountain shrubland. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are loamy-skeletal, mixed Pachic Argiborolls. These dominant and similar soils make up about 20 percent of the unit.

The Rock outcrop is on ridgetops and benches and near stream courses. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 5 percent of the unit. They are loamy-skeletal, mixed, frigid Typic Ustochrepts. They are in areas near the Rock outcrop. They have a light colored surface layer. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Mollic Eutroboralfs have a surface layer of pinkish gray very gravelly silt loam and clay loam. The surface layer is about 8 inches thick. The subsoil is pinkish gray very gravelly clay loam about 12 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly silt loam.

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

Management

Timber

Potential annual production in forested areas is 16 to 48 cubic feet per acre. Timber productivity in the map unit is limited by the Rock outcrop, the mountain grassland, and the mountain shrubland. The slope affects the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The slope and the Rock outcrop limit access to forage. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from water help to overcome these limitations. The average production for the potential native plant communities in the mountain grassland and

mountain shrubland is about 1,250 pounds per acre of air-dry herbage in a normal year. The forest understory produces a limited amount of forage. Forage production increases following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in fall and winter. It also can provide good habitat for blue grouse in spring and summer and good nesting habitat for raptors that nest on cliffs. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-3D—Mollic Cryoboralfs, mountain slopes, steep

This map unit is on mountain slopes. Elevation ranges from 6,500 to 7,800 feet. The vegetation consists of lower subalpine forest and dense Douglas-fir forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. Seeps and springs are in meadows. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

The vegetation is dense Douglas-fir forest or dense lodgepole pine forest and scattered, moist areas of mountain meadows. The forest understory is a mat of low-growing shrubs dominated by blue huckleberry and twinflower.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/ twinflower, which are at the higher elevations, and Douglas-fir/huckleberry, which is at the lower elevations, are the major habitat types. Also included in this unit are Douglas-fir/twinflower at the lower elevations and subalpine fir/grouse whortleberry at the higher elevations. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/bluejoint and subalpine fir/Sitka alder are along drainageways or in depressions. Their productivity for timber is higher than that of the major habitat types. Idaho fescue/bearded wheatgrass is in the mountain meadows. Douglas-fir/Idaho fescue is on south-facing slopes at the lower elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. Bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 15 to 35 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs. They have a somewhat dark surface layer. The similar soils have a slightly lighter colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. The dominant and similar soils make up about 85 percent of the unit.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Argic Pachic Cryoborolls. They are in meadows. They have a dark surface layer. The rock outcrop is on ridgetops and near stream courses.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

Management

Timber

The potential annual production ranges from 53 to 75 cubic feet per acre. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The mountain meadows are in about 10 percent of the unit but produce more than 90 percent of the forage. Because the forage is in widely scattered areas and because of the slope, however, access to the forage is limited. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose and elk in summer and fall. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-3E—Mollic Cryoboralfs, mountain slopes, cold, steep

This map unit is on mountain slopes. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. Avalanches occasionally occur in this unit. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

The vegetation in the forest includes stunted subalpine fir, whitebark pine, and some Engelmann spruce. Forest stands are open grown on ridges and dense on the lower slopes. The forest understory is a mat of shrubs and forbs dominated by grouse whortleberry and lupine.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir is at the higher elevations. A cold climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 65 percent of the unit.

Subalpine fir/grouse whortleberry, which is a dissimilar habitat type, is in about 25 percent of the unit. It is at the lower elevations. Its productivity for timber is higher than that of the major habitat type.

Geology

These soils are underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. Bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs. They have a somewhat dark surface layer. The similar soils have a lighter or darker colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Dystric Cryochrepts. They are in areas near the rock outcrop. They are moderately coarse textured. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is on ridgetops and near stream courses.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 16 to 32 cubic feet per acre. The slope limits the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are slick when wet.

Range

The slope severely limits access to forage. The forest

understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for grizzly bear, goats, and bighorn sheep in fall. It also can provide good habitat for blue grouse in fall. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-3F—Rock outcrop-Argic Cryoborolls-Mollic Cryoboralfs complex, steep

This map unit is on mountain slopes. Elevation ranges from 6,800 to 8,000 feet. The vegetation consists of lower subalpine forest and upper subalpine forest. The soils formed in material weathered from volcanic rocks.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts. The runoff rapidly transports eroded soil to the streams.

Vegetation

The vegetation is open-grown forest, dense lodgepole pine forest, and scattered areas of mountain grassland. On south-facing slopes the understory is dominated by pinegrass. On other aspects it is a mat of grouse whortleberry and pinegrass.

Habitat Types

Subalpine fir/pinegrass is the major habitat type on south-facing slopes. In places it is the major habitat type on the north-, east-, and west-facing slopes at the lower elevations. Moderate timber productivity is associated with this habitat type in this unit. This habitat type is in about 25 percent of the unit. Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type at the higher elevations. Low timber productivity is associated with this habitat type. This habitat type is in about 20 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Idaho fescue/bluebunch wheatgrass is in areas of the mountain grassland. Douglas-fir habitat types are at the lower elevations. They have an understory of bunchgrass or shrubs. Their productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by a repetitive sequence of lava flows, mudflow breccias, and welded tuffs. Bedrock varies in weathering resistance. The lava flows are resistant to weathering. The tuffs weather rapidly.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under open-grown forest have a dark surface layer, whereas soils that formed under dense forest have a somewhat dark surface layer.

Map Unit Composition

The Rock outcrop is in areas throughout this map unit. Rubble land is a similar component in the unit. The Rock outcrop and Rubble land make up about 40 percent of the unit.

The dominant soils are loamy-skeletal, mixed Argic Cryoborolls and loamy-skeletal, mixed Mollic Cryoboralfs.

The Argic Cryoborolls are in areas of open-grown forest. They make up about 30 percent of the unit.

The Mollic Cryoboralfs are in areas of dense forest. They make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Lithic Cryochrepts. They are in areas near the Rock outcrop. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 15 inches of pale brown clay loam and very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

Potential annual production is 36 to 64 cubic feet per acre in the lower subalpine forest and 16 to 32 cubic feet per acre in the upper subalpine forest. Productivity

in the map unit is limited by the Rock outcrop. The slope and the Rock outcrop limit the operation of tractors. Regeneration of the forest is limited by plant competition in areas of the lower subalpine forest and by harsh climate in areas of the upper subalpine forest. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

The slope increases the amount of material excavated during road construction. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The mountain grassland is in less than 10 percent of the unit but produces more than 90 percent of the forage. The forest understory produces a limited amount of forage. The slope, the Rock outcrop, and insufficient water for livestock are limitations affecting range.

Wildlife and fisheries

This map unit can provide good habitat for bighorn sheep and elk in fall. It also can provide good habitat for blue grouse in fall and good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-5A—Typic Argiborolls-Mollic Eutroboralfs-Rock outcrop association, steep

This map unit is on mountain slopes. Elevation ranges from 5,200 to 6,200 feet. The vegetation consists of open-grown forest on south-facing slopes and dense Douglas-fir forest on north-facing slopes. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have moderate water-holding capacity, and the potential for surface runoff is low.

Vegetation

The dense Douglas-fir forest has an understory of shrubs dominated by ninebark and snowberry. The open-grown Douglas-fir forest has an understory of bunchgrass dominated by Idaho fescue and bluebunch wheatgrass. Mountain grassland and mountain shrubland are on south-facing slopes.

Habitat Types

Douglas-fir/ninebark is the major habitat type on north-facing slopes. Douglas-fir/snowberry also is on these slopes. A warm, dry or moist climate and moderate timber productivity are associated with these habitat types in this unit. Douglas-fir/Idaho fescue is the major habitat type on south-facing slopes. Other Douglas-fir, limber pine, and ponderosa pine habitat types also are on these slopes. They have an understory of bunchgrass. A warm, dry climate and very low timber productivity are associated with these habitat types in this unit. These habitat types are in about 65 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are on south-facing slopes in areas of the mountain grassland and mountain shrubland.

Geology

This map unit is underlain by dark sandstone interbedded with thin layers of shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under open-grown forest have a dark surface layer, whereas soils that formed under dense Douglas-fir forest have a somewhat dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Argiborolls and loamy-skeletal, mixed Mollic Eutroboralfs.

The Typic Argiborolls are in areas of the open-grown forest. They make up about 40 percent of the unit.

The Mollic Eutroboralfs are in areas of the dense Douglas-fir forest. They make up about 30 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 20 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils make up about 10 percent of the unit.

They are loamy-skeletal, mixed, frigid Typic Ustochrepts and loamy-skeletal, mixed, frigid Lithic Ustochrepts. They are in areas near the Rock outcrop and on ridges. They have a light colored surface layer or are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

The Mollic Eutroboralfs have a surface layer of pinkish gray very gravelly silt loam about 8 inches thick. The subsoil is pinkish gray very gravelly clay loam about 12 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly silt loam.

Management

Timber

Potential annual production is 42 to 60 cubic feet per acre in the dense Douglas-fir forest and 16 to 26 cubic feet per acre in the open-grown forest. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

The slope increases the amount of material excavated during road construction. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The forest understory produces a moderate amount of forage. Forage production increases after timber harvest. The slope limits access to forage. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from water help to overcome these limitations.

Wildlife and fisheries

This map unit can provide good habitat for mule deer year round and for elk in fall and winter. It also can provide good habitat for blue grouse in spring and summer and good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

54-5C—Typic Cryoboralfs-Mollic Cryoboralfs-Rock outcrop complex, steep

This map unit is on mountain slopes. Elevation ranges from 6,000 to 7,500 feet. The vegetation consists of dense Douglas-fir forest on north-facing slopes and open-grown forest on south-facing slopes. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The mountain slopes are long and straight or slightly convex. Large streams are commonly at the base of the slopes. The soils on the landforms have moderate water-holding capacity, and the potential for surface runoff is low.

Vegetation

The dense Douglas-fir forest has an understory of shrubs dominated by ninebark and snowberry. The open-grown forest has an understory of bunchgrass dominated by Idaho fescue, bluebunch wheatgrass, and junegrass.

Habitat Types

Douglas-fir/ninebark is the major habitat type on north-facing slopes. Douglas-fir/snowberry also is on these slopes. A warm, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 35 percent of the unit. Douglas-fir/Idaho fescue is the major habitat type on south-facing slopes. Douglas-fir/bluebunch wheatgrass also is on these slopes. A warm, dry climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 30 percent of the unit.

Subalpine fir/blue huckleberry, which is a dissimilar habitat type, is in about 10 percent of the unit. It is at the higher elevations. Its productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by dark sandstone interbedded with shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 65 percent. Soil properties vary depending on the vegetation. Soils that formed under dense Douglas-fir forest have a light colored surface layer, whereas soils that formed under open-grown forest have a somewhat dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Mollic Cryoboralfs.

The Typic Cryoboralfs are in areas of the dense Douglas-fir forest. They make up about 35 percent of the unit.

The Mollic Cryoboralfs are in areas of the open-grown forest. They have a somewhat dark surface layer. The similar soils have a dark surface layer. They are loamy-skeletal, mixed Argic Cryoborolls. These dominant and similar soils make up about 25 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 25 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Typic Haploborolls. They are in areas near the Rock outcrop. They do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 10 inches thick. The lower part is 31 inches of pale brown very stony loam and very stony clay loam. The substratum to a depth of 60 inches or more is very pale brown extremely stony loam.

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

Potential annual production is 42 to 60 cubic feet per acre in the dense Douglas-fir forest and 16 to 26 cubic feet per acre in the open-grown forest. Productivity in the map unit is limited by the Rock outcrop. The slope and the Rock outcrop limit the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

The slope increases the amount of material excavated during road construction. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The slope severely limits access to forage. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from water help to overcome these limitations. Forage production is moderate on south-facing slopes, but it is limited on north-facing slopes. It increases following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall. It also can provide good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer, elk, and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

61-2A—Typic Argiborolls and Typic Calciborolls, alluvial fans

This map unit is on alluvial fans. Elevation ranges from 5,400 to 6,500 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in alluvial deposits.

Landform

The dominant slopes have gradients of 10 to 20 percent. The alluvial fans are in areas where steep mountain streams enter valleys. Seeps and springs are on some stream bottoms. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue and common forbs. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in moist areas of this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Big sagebrush/Idaho fescue and Idaho fescue/bluebunch wheatgrass are the major habitat types. Douglas-fir habitat types also are in this unit. They have an understory of bunchgrass. A warm, somewhat dry climate and moderate forage productivity are associated

with these habitat types in this unit. These habitat types are in about 90 percent of the unit.

Subalpine fir habitat types, which are dissimilar habitat types, are in about 10 percent of the unit. They are at the higher elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

These soils are underlain by stratified alluvial deposits weathered from shale, sandstone, or limestone. Glacial till is in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 60 percent. Soil properties vary depending on the location of the soils. Delineations in the Bridger Range and the northern part of the Absaroka-Beartooth Range include soils that formed in material weathered from limestone. These soils have a high content of lime in the subsoil and substratum. Other delineations have soils that formed in material weathered from shale and sandstone. These soils have a lower content of lime in the subsoil and substratum than the soils that formed in material weathered from limestone.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Argiborolls and loamy-skeletal, carbonatic Typic Calciborolls.

The Typic Argiborolls formed in material weathered from sandstone and shale. They have an accumulation of clay in the subsoil. The similar soils do not have an accumulation of clay in the subsoil. They are loamy-skeletal, mixed Typic Haploborolls.

The Typic Calciborolls formed in material weathered from limestone. They have a dark surface layer. The similar soils have a light colored surface layer. They are loamy-skeletal, carbonatic, frigid Typic Ustochrepts.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Dissimilar soils make up about 5 percent of the unit. They are Aquic Argiborolls and Argiaquolls. They are along streams and are somewhat poorly drained. Their productivity for forage is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

The Typic Calciborolls have a surface layer of calcareous, dark grayish brown very gravelly silt loam about 20 inches thick. The subsoil is calcareous, pale brown very gravelly loam about 7 inches thick. The substratum to a depth of 60 inches or more is calcareous, very pale brown very cobbly loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 800 to 2,300 pounds per acre of air-dry herbage in a normal year. The soils that have a very limey subsoil have the lower potential productivity. They are in areas of the Bridger Range and the northern part of the Absaroka-Beartooth Range. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. In places controlling the sagebrush improves production of desirable forage plants. Insufficient water for livestock is a limitation.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose.

64-2A—Typic Cryoborolls and Argic Cryoborolls, terraces and flood plains

This map unit is on terraces and flood plains. Elevation ranges from 6,500 to 8,000 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in glacial outwash deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The terraces and flood plains are on the bottom of valleys bordering streams. Deposits from avalanches that occur on adjacent slopes occasionally are in these valleys. Also included in this unit are some alluvial fans and stream terraces. The landforms commonly contain one major stream. The soils are subject to flooding after prolonged, high intensity

storms. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue and forbs. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in moist areas of this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Big sagebrush/Idaho fescue and Idaho fescue/bluebunch wheatgrass are the major habitat types. Douglas-fir habitat types also are in this unit. They have an understory of bunchgrass. A warm, somewhat dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir habitat types are at the higher elevations. Their productivity for timber is higher than that of the major habitat types. Riparian communities are along perennial streams. Their productivity for forage is higher than that of the major habitat types.

Geology

These soils are underlain by stratified glacial outwash deposits weathered from granitic rocks or from sandstone and shale or limestone.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured or medium textured surface layer. The content of rock fragments in the subsoil ranges from 10 to 50 percent. Soil properties vary depending on the parent material. Soils that formed in material weathered from granitic rock or limestone do not have an accumulation of clay in the subsoil, whereas soils that formed in material weathered from sandstone and shale have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoborolls and loamy-skeletal, mixed Argic Cryoborolls.

The Typic Cryoborolls formed in material weathered from granitic rocks and limestone.

The Argic Cryoborolls formed in material weathered from sandstone and shale. They have a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a 10 to 35 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Argic Cryoborolls.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Mollic Cryoboralfs; loamy-skeletal, mixed Argic Pachic Cryoborolls; and Cryaquolls. The Mollic Cryoboralfs are in areas of some included forests. The Argic Pachic Cryoborolls and Cryaquolls are on flood plains. They are wet and have low strength.

Representative Profile of the Soils

The Typic Cryoborolls have a surface layer of dark grayish brown loam and sandy loam. The surface layer is about 7 inches thick. The upper 9 inches of the subsoil is dark grayish brown very gravelly loam and very gravelly sandy loam. The lower 6 inches is dark grayish brown very cobbly loam and very cobbly sandy loam. The substratum to a depth of 60 inches or more is grayish brown very cobbly loam and very cobbly sandy loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam and very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to erode. Avalanches can increase the cost of maintaining the roads. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. When roads are constructed in or near stream channels, measures should be taken to prevent sediment from entering the channel system.

Range

The average production for the potential native plant communities is about 1,728 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces some forage. The forested areas have good potential for use as transitory range. In places controlling the sagebrush improves production of desirable forage plants. Livestock tend to gather on stream bottoms.

Wildlife and fisheries

This map unit can provide good habitat for moose in fall and winter. Moose and grizzly bear tend to be in the moist and wet areas. The major streams in the unit provide habitat for trout.

64-2C—Typic Cryoboralfs and Argic Cryoborolls, terraces and flood plains

This map unit is on terraces and flood plains. Elevation ranges from 6,000 to 7,000 feet. The vegetation consists of lower subalpine forest. The soils formed in alluvial or glacial outwash deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The terraces and flood plains are on the bottom of valleys bordering streams. Deposits from avalanches that occur on adjacent, steep slopes are common in the valleys. Included in this unit are some alluvial fans and stream terraces. Seeps and springs are in depressions and on low terraces. The landforms commonly contain one major stream. The soils are subject to flooding after prolonged, high intensity storms. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest and spruce forest at the higher elevations and Douglas-fir forest and some areas of mountain meadows at the lower elevations. At the higher elevations the forest understory is a dense mat of shrubs dominated by blue huckleberry and grouse whortleberry. At the lower elevations it contains snowberry and ninebark. Near the streams and seeps, it contains baneberry, horsetail, sweetscented bedstraw, and bluejoint.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/grouse whortleberry are the major habitat types at the higher elevations. Subalpine fir and spruce habitat types are the major habitat types on wet soils at the lower elevations. Douglas-fir and spruce habitat types are in the drier areas at the lower elevations. They have an understory of shrubs. A cool, moist climate and high timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Idaho fescue/bearded wheatgrass, which is a dissimilar habitat type, is in about 20 percent of the unit. It is in the mountain meadows.

Geology

These soils are underlain by stratified glacial outwash and alluvial deposits.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under dense lodgepole pine and spruce forest have a light colored surface layer, whereas soils that formed under Douglas-fir forest have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls.

The Typic Cryoboralfs are in the areas of dense lodgepole pine forest and spruce forest.

The Argic Cryoborolls are in the areas of Douglas-fir forest. They have a thick, dark surface layer. The similar soils have a very thick, dark surface layer. They are loamy-skeletal, mixed Argic Pachic Cryoborolls.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Dissimilar soils make up about 20 percent of the unit. They are loamy-skeletal, mixed Aquic Cryoboralfs and Cryaquolls. The Aquic Cryoboralfs are on flood plains, in depressions, and on low terraces. They are somewhat poorly drained and have low strength. Their productivity for timber is higher than that of the dominant soils. The Cryaquolls are near streams and seeps. They are poorly drained, have low strength, and are periodically flooded.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 10 inches thick. The lower 31 inches is pale brown very stony loam and very stony clay loam. The substratum to a depth of 60 inches or more is very pale brown very stony loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam to very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production ranges from 65 to 97

cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

Roads should not be built in wet areas. Providing suitable subgrade material helps to prevent the damage caused by wetness. The material exposed on steep cutbanks during road construction tends to erode. Avalanches can increase the cost of maintaining the roads.

Range

The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are well suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk and moose in summer and fall and for grizzly bear in summer. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings occur in the forest understory. It provides good security cover for mule deer, elk, and moose. The major streams in the unit provide habitat for trout.

66-1A—Cryaquolls and Cryaquents, flood plains

This map unit is on flood plains and terraces. Elevation ranges from 6,600 to 8,600 feet. The vegetation consists of mountain meadows and riparian communities. The soils formed in alluvial deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The flood plains and the terraces are on the bottom of valleys along stream channels. They commonly contain ponds and bogs. The soils are frequently flooded. They have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation dominantly is wet mountain meadows and riparian community types. Forest or moist meadows are in some areas. The species in the mountain meadows are tufted hairgrass, timber oatgrass, timothy, rushes, and bentgrass.

Habitat Types

Tufted hairgrass/sedge is the major habitat type in the mountain meadows. Willow communities are the major riparian community types. A cool, very wet site and high forage productivity are associated with these habitat types in this unit. These habitat types are in about 90 percent of the unit.

Subalpine fir and Engelmann spruce habitat types, which are dissimilar habitat types, are in about 10 percent of the unit. They are somewhat poorly drained and are on benches and terraces.

Geology

These soils are underlain by stratified alluvial deposits of sand, silt, and gravel.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. In places they are occasionally flooded during spring snowmelt. Soil properties vary depending on the age of the alluvial deposits. Soils that formed in the older deposits have a dark surface layer, whereas soils that formed in recent deposits have a light colored surface layer.

Map Unit Composition

The dominant soils are Cryaquolls and Cryaquents. The Cryaquolls formed in the older alluvial deposits. The Cryaquents formed in the recent deposits.

Delineations of this map unit can include both of the dominant soils, or they can include only one of the soils.

Representative Profile of the Soils

No one profile can represent the soils in this unit. In one of the more common profiles, however, the Cryaquolls have a surface layer of very dark grayish brown, very dark gray, and dark grayish brown silt loam about 9 inches thick. The subsoil is about 5 inches of grayish brown sandy clay loam mottled with strong brown and yellowish brown. The substratum to a depth of 60 inches or more is very pale brown and light gray sandy clay loam and gravelly sandy clay loam. It has strong brown mottles.

In another of the more common profiles, the Cryaquents have a surface layer of dark gray silt loam about 4 inches thick. The substratum to a depth of 60 inches or more is gray, light gray, and light brownish gray stratified silt loam, very fine sandy loam, gravelly sandy loam, loamy sand, and very cobbly loamy sand. It has yellowish brown mottles.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Roads should not be built in wet areas. Providing suitable subgrade material helps to prevent the damage caused by wetness. The material exposed on steep cutbanks during road construction tends to erode. When roads are constructed in or near stream channels,

measures should be taken to prevent sediment from entering the channel system. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

In most areas the soils in this unit are too wet to support livestock most of the time. Delaying grazing until the soils have dried out helps to prevent the damage caused by trampling. Livestock tend to gather in wet areas and overgraze the vegetation rather than grazing in the adjacent uplands. The average production for the potential native plant communities is about 3,400 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the wet meadows can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for moose in summer and fall and for elk and grizzly bear in summer. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. The major streams in the unit provide habitat for trout.

71-1A—Aquic Cryoboralfs-Typic Cryoboralfs complex, landslides

This map unit is on landslides. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20 percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement, such as large cracks, leaning trees, slip scars, and lobate-shaped deposits, are present. Seeps, springs, and small ponds are in some depressions. About 40 to 60 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts runoff into ponds and bogs. Included in this unit are some structurally controlled sandstone ridges, which are more stable than the landslides.

Vegetation

The vegetation is mostly dense lodgepole pine forest and scattered areas of mountain meadows. Engelmann spruce and subalpine fir forest is in depressional areas and near seeps or springs. The forest understory contains twinflower or blue huckleberry on moderately well drained knobs; baneberry, twisted stalk, and sweetscented bedstraw in depressions; and bluejoint in poorly drained areas near seeps and springs.

Habitat Types

Subalpine fir/sweetscented bedstraw and subalpine fir/bluejoint are the major habitat types in the depressions. Wet soils and high timber productivity are associated with these habitat types in this unit. These habitat types are in about 45 percent of the unit. Subalpine fir/twinflower and subalpine fir/blue huckleberry are the major habitat types on mounds. A cool climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 30 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Idaho fescue/bearded wheatgrass is in the meadows. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from interbedded shale, mudstone, siltstone, and some sandstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 0 to 15 percent. Soil properties vary depending on the topography. Soils in depressions are wet and have low strength, whereas soils on mounds are well drained.

Map Unit Composition

The dominant soils are fine-loamy, mixed Aquic Cryoboralfs and fine-loamy, mixed Typic Cryoboralfs.

The Aquic Cryoboralfs are in depressions. They make up about 50 percent of the unit.

The Typic Cryoboralfs are on mounds. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are Argic Cryaquolls and Argiaquic Cryoborolls. They are in the mountain meadows. They are poorly drained and have a thick, dark surface layer.

Representative Profile of the Soils

The Aquic Cryoboralfs have a surface layer of light gray silt loam about 7 inches thick. The upper part of

the subsoil is light brownish gray clay loam about 6 inches thick. The lower part is light gray sandy clay loam about 7 inches thick. The substratum to a depth of 60 inches or more is grayish brown gravelly clay loam.

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Management

Timber

The potential annual production ranges from 52 to 90 cubic feet per acre. The operation of tractors is limited by low strength in wet areas. Operating tractors in wet areas results in the formation of ruts and lower soil productivity. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. Providing suitable subgrade material helps to prevent the damage caused by wetness. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. The material exposed on steep cutbanks during road construction tends to slough and erode.

Range

The mountain meadows are in about 15 percent of the unit but produce 90 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose and grizzly bear in summer and fall and for elk in summer. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The streams and small lakes in the unit provide habitat for trout.

71-1B—Argic Cryoborolls-Argic Pachic Cryoborolls complex, landslides

This map unit is on landslides. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of mountain grassland, mountain shrubland, and lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20 percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of past, rapid movement, such as large cracks, slip scars, and lobate-shaped deposits, are present. About 20 to 40 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into ponds and bogs. Included in this unit are some structurally controlled sandstone ridges, which are not subject to landslides.

Vegetation

Lodgepole pine forest and subalpine fir forest are at the higher elevations. The forest understory is dominated by pinegrass and low-growing shrubs. The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue and forbs. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in moist areas. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major grassland and shrubland habitat types. Idaho fescue/bearded wheatgrass is in depressions. A warm, moist climate and moderate forage productivity are associated with the mountain grassland and mountain shrubland habitat types in this unit. These habitat types are in about 60 percent of the unit. Subalpine fir habitat types are the major habitat types in the lodgepole pine forest. Moderate timber productivity is associated with the subalpine fir habitat types in this unit. These habitat types are in about 20 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Douglas-fir/snowberry is at the lower elevations. Its productivity for timber is lower than that of the major habitat types. Regeneration of Douglas-fir/snowberry is limited. Tufted hairgrass/sedges is in wet areas. Its productivity for forage is higher than that of the major habitat types.

Geology

These soils are underlain by material deposited by

landslides. The material is weathered from shale, mudstone, siltstone, and some sandstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 0 to 15 percent. Soil properties vary depending on the topography. Soils on mounds and benches have a dark surface layer, whereas soils in swales or depressions have a very thick, dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Argic Pachic Cryoborolls.

The Argic Cryoborolls are on mounds and benches. They make up about 50 percent of the unit.

The Argic Pachic Cryoborolls are in swales or depressions. They make up about 30 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 20 percent of the unit. They are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryaquolls. The Mollic Cryoboralfs are in forested areas. They have a lighter colored surface layer than the dominant soils. Also, their productivity for timber is higher than that of the dominant soils. The Argic Cryaquolls are on stream bottoms and in wet meadows. They are poorly drained. Their productivity for forage is higher than that of the dominant soils.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown clay loam.

The Argic Pachic Cryoborolls have a surface layer of grayish brown silt loam about 9 inches thick. The subsoil is brown clay loam about 19 inches thick. The substratum to a depth of 60 inches or more is yellowish brown loam.

Management

Timber

Potential annual production in forested areas is 52 to 68 cubic feet per acre. Timber productivity in the map unit is limited by the mountain grassland and mountain shrubland. The terrain is well suited to the operation of tractors.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,634 to 2,338 pounds per acre of air-dry herbage in a normal year. About 35 percent of the soils in this unit are in depressions or in somewhat poorly drained meadows; however, these soils produce more than 60 percent of the available forage and livestock tend to gather in these areas. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. Brush control increases forage production in areas of big sagebrush.

Wildlife and fisheries

This map unit can provide good habitat for elk and mule deer in fall and winter. Most delineations of this unit are within the range of elk from the northern part of Yellowstone National Park. They can provide range in winter for the elk.

71-1C—Typic Cryoboralfs-Aquic Cryoboralfs complex, landslides, cold

This map unit is on landslides. Elevation ranges from 7,800 to 8,600 feet. The vegetation consists of upper subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20 percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of past, rapid movement, such as large cracks, leaning trees, slip scars, and lobate-shaped deposits, are present. Seeps, springs, and small ponds are in some depressions. About 40 to 60 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into ponds and bogs. Included in this unit are some structurally controlled sandstone ridges, which are not subject to landslides.

Vegetation

The vegetation includes stunted subalpine fir, whitebark pine, and lodgepole pine in forested areas and scattered areas of mountain meadows. The forest

canopy is open grown at the higher elevations. The forest understory is a mat of shrubs dominated by grouse whortleberry. Heartleaf arnica and lupine are in places.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type at the mid and upper elevations. Subalpine fir/blue huckleberry and subalpine fir/grouse whortleberry are the major habitat types at the lower elevations. Whitebark pine/subalpine fir also is at the higher elevations, and subalpine fir/heartleaf arnica and subalpine fir/twinflower are at the lower elevations. A cold climate and low timber productivity are associated with these habitat types. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Idaho fescue/bearded wheatgrass and tufted hairgrass/sedge are in the meadows. Subalpine fir/sweetscented bedstraw is in the poorly drained areas at the lower elevations. Its productivity for timber is higher than that of the major habitat types.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from shale, mudstone, siltstone, and some sandstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 0 to 15 percent. Soil properties vary depending on the topography. Soils on mounds are well drained, whereas soils in depressions are wet and have low strength.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and fine-loamy, mixed Aquic Cryoboralfs.

The Typic Cryoboralfs are on mounds. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Aquic Cryoboralfs are in depressions. They make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rubble land make up about 15 percent of the unit. The dissimilar soils are Argic Cryaquolls and Argiaquic Cryoborolls. They are in the meadows. They are poorly drained and have a thick, dark surface layer. The rubble land is in areas throughout the unit.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Aquic Cryoboralfs have a surface layer of light gray silt loam about 4 inches thick. The upper part of the subsoil is light brownish gray clay loam about 9 inches thick. The lower part is light gray sandy clay loam about 7 inches thick. The substratum to a depth of 60 inches or more is grayish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 32 to 50 cubic feet per acre. The operation of tractors is limited by low strength in wet areas. If ruts are formed and the soil is puddled, productivity is reduced. Regeneration of the forest is limited by the harsh climate. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. Providing suitable subgrade material helps to prevent the damage caused by wetness. The material exposed on steep cutbanks during road construction tends to slough and erode and is difficult to revegetate because of the harsh climate. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The meadows are in about 15 percent of the unit but produce 90 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The invasion of timothy into some of the meadows can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk, moose, and grizzly bear in summer and some habitat for them in fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings

are in the forest understory. It can provide good habitat for blue grouse in fall. It provides good security cover for mule deer, elk, and moose. The larger streams and small lakes in the unit provide habitat for trout.

71-1D—Typic Cryoboralfs-Typic Cryochrepts complex, landslides

This map unit is on landslides. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20 percent. The landslides are characterized by an irregular series of benches intermingled with some hummocky land surfaces. In areas where the streams have well defined channels, the banks are nearly vertical. About 5 to 20 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into ponds and swales. Included in this unit are some structurally controlled sandstone ridges, which are not subject to landslides.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from sandstone and shale or glacial till.

Vegetation

The vegetation is mostly dense lodgepole pine forest and scattered areas of mountain meadows. Engelmann spruce is common in depressions. At the higher elevations whitebark pine and subalpine fir are mixed with the lodgepole pine. The forest understory is a thick mat of pinegrass on south-facing slopes and heartleaf arnica and grouse whortleberry on north-facing slopes. Twinflower is in depressions.

Habitat Types

Subalpine fir/pinegrass is the major habitat type on south-facing slopes and on some west-facing slopes. Subalpine fir/grouse whortleberry is the major habitat type on north- and east-facing slopes. Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type at the higher elevations. Engelmann spruce/twinflower is the major habitat type in depressions and near seeps. Subalpine fir/blue huckleberry is on north-facing slopes, and subalpine fir/twinflower is in depressions. A cool, moist climate and moderate timber productivity are associated with the habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Idaho fescue/bearded wheatgrass is in the meadows. Douglas-fir/snowberry is at the lower elevations. Regeneration of Douglas-fir/snowberry is limited.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 10 to 50 percent. Soil properties vary depending on the topography. Soils on benches and in swales are moderately fine textured in the lower part of the subsoil. They have an accumulation of clay in the subsoil. Soils on ridges are moderately coarse textured in the lower part of the subsoil. They do not have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs are on benches and in swales. They have a light colored surface layer and a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a thin, dark surface layer or a 10 to 35 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Mollic Cryoboralfs and fine-loamy, mixed Typic Cryoboralfs. These dominant and similar soils make up about 40 percent of the unit.

The Typic Cryochrepts are on ridges. They have a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a 10 to 35 percent content of rock fragments in the subsoil. They are coarse-loamy, mixed Typic Cryochrepts. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rubble land make up about 25 percent of the unit. The dissimilar soils are Argic Cryoborolls, Argic Pachic Cryoborolls, and Argic Cryaquolls. The Argic Cryoborolls and Argic Pachic Cryoborolls are in the meadows and in some of the forested areas. They have a thick, dark surface layer. Their productivity for timber is lower than that of the dominant soils. The Argic Cryaquolls are in the ponds and swales. They are poorly drained and have low strength. The rubble land is on ridges that are underlain by sandstone.

Representative Profile of the Soils

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs have a surface layer of very

pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 29 inches thick. The lower 12 inches is pale brown very stony loam to clay loam. The substratum to a depth of 60 inches or more is very pale brown very stony loam.

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built.

Range

The meadows are in 10 percent of the unit but provide 80 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The forest understory produces a limited amount of forage. Forage production increases after timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk in summer and fall and for grizzly bear in summer. It provides good security cover for mule deer, elk, and moose.

71-1E—Mollic Cryoboralfs-Argic Cryoborolls complex, landslides

This map unit is on landslides. Elevation ranges from 6,700 to 7,500 feet. The vegetation consists of dense Douglas-fir forest and lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes are on south aspects. They have gradients of 5 to 20 percent. The landslides are characterized by an irregular series of benches intermingled with some hummocky land surfaces. Seeps and springs occur in places. About 5 to 20 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into seeps and swales. Included in this unit are some structurally controlled sandstone ridges, which are not subject to landslides.

Vegetation

The vegetation is open-grown or dense Douglas-fir forest and lodgepole pine forest and scattered areas of mountain grassland. The forest understory is a thick stand of shrubs dominated by snowberry and blue huckleberry.

Habitat Types

Douglas-fir/snowberry and Douglas-fir/blue huckleberry are the major habitat types on south-facing slopes and at the lower elevations on north-facing slopes. These habitat types are in about 45 percent of the unit. Subalpine fir/blue huckleberry is the major habitat type on north-facing slopes at the higher elevations. Subalpine fir/grouse whortleberry also is on north-facing slopes at the higher elevations. These habitat types are in about 30 percent of the unit. A cool climate and moderate timber productivity are associated with these habitat types in this unit.

Dissimilar habitat types are in about 25 percent of the unit. Idaho fescue/bluebunch wheatgrass is in the mountain grassland. Douglas-fir and limber pine habitat types are at the lower elevations on south-facing slopes. They have an understory of bunchgrass. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from shale, mudstone, siltstone, and some sandstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 0 to 20 percent. Soil properties vary depending on the vegetation. Soils that formed under dense forest have a somewhat dark surface layer, whereas soils that formed under open-grown forest have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in areas of dense forest. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. These dominant and similar soils make up about 60 percent of the unit.

The Argic Cryoborolls are in areas of open-grown forest. They make up about 30 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Rubble land makes up about 10 percent of the unit. It is on ridges that are underlain by sandstone.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 54 to 76 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by plant competition in the dense Douglas-fir forest. The understory vegetation competes vigorously with tree seedlings for the limited available water. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory produces a limited amount of forage. The mountain grassland is in about 15 percent of the unit but produces more than 50 percent of the available forage. Because the forage is in scattered areas, however, access to it is limited. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall and for elk in fall. It also provides good habitat for blue grouse in fall.

71-2A—Typic Cryoboralfs-Aquic Cryoboralfs complex, landslides

This map unit is on landslides. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20 percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of past, rapid movement, such as large cracks, leaning trees, slip scars, and lobate-shaped deposits, are in the unit. Seeps, springs, and small lakes are in depressions. About 20 to 40 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into ponds and bogs. Included in this unit are some structurally controlled ridges that are underlain by volcanic bedrock. The ridges are not subject to landslides.

Vegetation

The vegetation is mostly dense lodgepole pine forest and some scattered areas of mountain meadows. Engelmann spruce and subalpine fir forest is in depressions and near seeps and springs. The forest understory is a thick mat of low-growing shrubs. Twinflower or blue huckleberry is on mounds and ridges. Baneberry, twistedstalk, sweetscented bedstraw, common horsetail, and bluejoint are in depressions and near seeps and springs.

Habitat Types

Subalpine fir/twinflower, subalpine fir/blue huckleberry, and subalpine fir/grouse whortleberry are the major habitat types on mounds and ridges. A cool climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 70 percent of the unit. Subalpine fir/sweetscented bedstraw, subalpine fir/bluejoint, and spruce/common horsetail are the major habitat types in depressions. Wet soils and high timber productivity are associated with these habitat types in this unit. These

habitat types are in about 20 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Idaho fescue/bearded wheatgrass is in the meadows. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 35 percent. Soil properties vary depending on the topography. Soils on mounds are well drained, whereas soils in depressions are wet and have low strength.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and fine-loamy, mixed Aquic Cryoboralfs.

The Typic Cryoboralfs are on mounds. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Aquic Cryoboralfs are in depressions. They make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rubble land make up about 15 percent of the unit. The dissimilar soils are Argic Cryaquolls and Argiaquic Cryoborolls. They are in the meadows. They are poorly drained and have a thick, dark surface layer. The rubble land is on ridges that are underlain by volcanic rocks.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Aquic Cryoboralfs have a surface layer of light gray silt loam about 4 inches thick. The upper part of the subsoil is light brownish gray clay loam about 9 inches thick. The lower part is light gray sandy clay loam about 7 inches thick. The substratum to a depth of 60 inches or more is grayish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 66 to 86 cubic feet per acre. The operation of tractors is limited by low strength in wet areas. Operating tractors in wet areas also results in compaction and the formation of ruts. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. Providing suitable subgrade material helps to prevent the damage caused by wetness. The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The meadows are in 10 percent of the unit but produce 90 percent of the available forage. Because the forage is in scattered areas, however, access to it is limited. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk, grizzly bear, and moose in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The larger streams and small lakes in the unit provide habitat for trout.

71-2B—Typic Cryoboralfs, landslides, cool

This map unit is on landslides. Elevation ranges from 7,000 to 8,200 feet. The vegetation consists of lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20 percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of past, rapid movement, such as large cracks, leaning trees, slip scars, and lobate-shaped deposits, are in drainageways and near seeps. About 5 to 20 percent of the unit is subject to further landslides. The soils on the landforms have high water-

holding capacity. The deranged drainage system diverts surface runoff into depressions. Included in this unit are some structurally controlled ridges that are underlain by volcanic bedrock. The ridges are not subject to landslides.

Vegetation

The vegetation is dense lodgepole pine forest and scattered areas of mountain meadows. The forest understory is a thick mat of shrubs. It is dominated by grouse whortleberry and blue huckleberry on north-facing slopes and by pinegrass on south-facing slopes.

Habitat Types

Subalpine fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir/pinegrass is on south-facing slopes. Subalpine fir/heartleaf arnica is also in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 25 percent of the unit. Idaho fescue/bearded wheatgrass is in the mountain meadows. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 15 to 50 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs. They have a light colored surface layer and a 15 to 35 percent content of rock fragments in the subsoil. The similar soils have a somewhat dark surface layer or a 35 to 50 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 90 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rubble land make up about 10 percent of the unit. The dissimilar soils are fine-loamy, mixed Argic Cryoborolls. They are in meadows and have a thick, dark surface layer. The rubble land is on ridges that are underlain by volcanic rocks.

Representative Profile of the Soils

The dominant soils have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Management

Timber

The potential annual production ranges from 53 to 71 cubic feet per acre. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The mountain meadows are in 15 percent of the unit but produce 90 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The invasion of timothy into some of the meadows can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. Forage production increases following timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose in summer and fall and for grizzly bear in summer. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The streams in the unit provide habitat for trout.

71-2C—Mollic Cryoboralfs-Argic Cryoborolls complex, landslides, cold

This map unit is on landslides. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of upper subalpine forest and lower subalpine forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes have gradients of 5 to 20

percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of past, rapid movement, such as large cracks, leaning trees, slip scars, and lobate-shaped deposits, are in the unit. Seeps and ponds are in depressions. About 20 to 40 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into the depressions and the ponds. Included in this unit are some structurally controlled ridges that are underlain by volcanic rocks. The ridges are not subject to landslides.

Vegetation

Stunted, open-grown lodgepole pine forest and whitebark pine forest are at the higher elevations. Dense lodgepole pine forest is at the lower elevations. The forest understory is a sparse mat of shrubs dominated by grouse whortleberry, heartleaf arnica, and lupine. Scattered areas of mountain meadows are in this unit.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type at the higher elevations. Whitebark pine/subalpine fir also is in the unit. A cold climate and low timber productivity are associated with these habitat types. These habitat types are in about 55 percent of the unit. Subalpine fir/grouse whortleberry, subalpine fir/blue huckleberry, and subalpine fir/ twinflower are the major habitat types at the lower elevations. A cool, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 30 percent of the unit.

Idaho fescue/bearded wheatgrass, which is a dissimilar habitat type, is in about 15 percent of the unit. It is in moist areas of mountain meadows.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under dense forest have a somewhat dark surface layer, whereas soils that formed under open-grown forest have a thick, dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in areas of dense forest. They have a somewhat dark surface layer and a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a light colored surface layer or a 35 to 50 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Typic Cryoboralfs and loamy-skeletal, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 55 percent of the unit.

The Argic Cryoborolls are in areas of open-grown forest. They have a thick, dark surface layer and a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a very thick, dark surface layer or a 35 to 50 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Argic Pachic Cryoborolls and loamy-skeletal, mixed Argic Cryoborolls. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rubble land make up about 10 percent of the unit. The dissimilar soils are fine-loamy, mixed Argic Cryaquolls. They are in poorly drained meadows and have low strength. The rubble land is on ridges that are underlain by volcanic rocks.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 34 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 32 to 50 cubic feet per acre at the higher elevations and from 53 to 71 cubic feet per acre at the lower elevations. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate in the upper subalpine forest. Trees are commonly poorly formed and can have spiral grain. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because

of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of the harsh climate. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The meadows are in 15 percent of the unit but produce 90 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose and grizzly bear in summer and fall and for elk in summer. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose. The large streams and small lakes in the unit provide habitat for trout.

71-2D—Argic Cryoborolls-Mollic Cryoboralfs complex, landslides, volcanic substratum

This map unit is on landslides. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of mountain grassland, mountain shrubland, and dense Douglas-fir forest. The soils formed in material deposited by landslides.

Landform

The dominant slopes are on south aspects. They have gradients of 5 to 20 percent. The landslides are hummocky land surfaces characterized by a regular pattern of mounds and depressions. Indicators of movement, such as large cracks, leaning trees, slip scars, and lobate-shaped deposits, are in the drainageways and near seeps. About 5 to 20 percent of the unit is subject to further landslides. The soils on the landforms have high water-holding capacity. The deranged drainage system diverts surface runoff into the depressions. Included in this unit are some structurally controlled ridges that are underlain by volcanic rocks. The ridges are not subject to landslides.

Vegetation

The mountain shrubland contains big sagebrush and an understory dominated by Idaho fescue and forbs. The mountain grassland is dominated by Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are common in moist areas. Douglas-fir seedlings are invading some of the areas of mountain grassland and mountain shrubland. The dense Douglas-fir forest has an understory dominated by blue huckleberry and snowberry.

Habitat Types

Big sagebrush/Idaho fescue and Idaho fescue/bluebunch wheatgrass are the major habitat types in the areas of mountain grassland and mountain shrubland. Open-grown limber pine and Douglas-fir forests also are in these areas. They have an understory of grasses. A warm, dry climate and moderate forage productivity are associated with these habitat types. These habitat types are in about 60 percent of the unit. Douglas-fir/blue huckleberry and Douglas-fir/snowberry are the major habitat types in the forested areas. Douglas-fir/ninebark also is in these areas. A warm, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 30 percent of the unit.

Subalpine fir/twinflower, which is a dissimilar habitat type, is in about 10 percent of the unit. It is at the higher elevations. Its productivity for timber is higher than that of the major habitat types.

Geology

These soils are underlain by material deposited by landslides. The material is weathered from volcanic rocks.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under mountain grassland and mountain shrubland have a dark surface layer, whereas soils that formed under dense forest have a somewhat dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Mollic Cryoboralfs.

The Argic Cryoborolls are in areas of the mountain grassland and mountain shrubland. They have a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a 35 to 50 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Argic Cryoborolls. These dominant and similar soils make up about 60 percent of the unit.

The Mollic Cryoboralfs are in areas of the dense forest. They have a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a 35 to

50 percent content of rock fragments in the subsoil. They are loamy-skeletal, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 30 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are fine-loamy, mixed Argic Pachic Cryoborolls. They are in swales and near seeps. They have a thick, dark surface layer. Their productivity for forage is higher than that of the dominant soils.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 9 inches thick. The subsoil is brown clay loam about 31 inches thick. The substratum to a depth of 60 inches or more is yellowish brown loam.

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

Management

Timber

Potential annual production of the forested areas is 47 to 75 cubic feet per acre. Timber productivity in the map unit is limited by the mountain grassland and mountain shrubland. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,635 to 1,820 pounds per acre of air-dry herbage in a normal year. Livestock tend to gather in the seeps and swales. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. In places controlling the sagebrush improves production of desirable forage plants and the access to forage.

Wildlife and fisheries

This map unit can provide good habitat for elk and mule deer in fall and winter. It provides good habitat for blue grouse in summer.

82-2B—Typic Cryoboralfs, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on north aspects. They have gradients of 10 to 20 percent. The structurally controlled slopes are roughly parallel to the dip of the underlying bedrock. The slopes generally are widest at the base and gradually taper upward. Also included are small benches and swales having a slope that is not parallel to the dip of the underlying bedrock. Deposits from landslides are in drainageways and near seeps. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is mostly dense lodgepole pine forest and scattered areas of mountain meadows. Engelmann spruce forest and subalpine fir forest are in moist depressions and along stream bottoms. Low-growing shrubs are in the forest understory. They dominantly are blue huckleberry, grouse whortleberry, and twinflower.

Habitat Types

Subalpine-fir/grouse whortleberry and subalpine fir/blue huckleberry are the major habitat types in areas of well drained soils. Subalpine fir/twinflower is the major habitat type in the depressions and on stream bottoms. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations, and subalpine fir/pinegrass and subalpine fir/heartleaf arnica are at the lower elevations. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 75 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Douglas-fir/snowberry is at the lower elevations where droughtiness limits regeneration of the forest. Spruce habitat types are in moist areas. Their

productivity for timber is higher than that of the major habitat types. Idaho fescue/bearded wheatgrass is in the mountain meadows.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 15 to 35 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are fine-loamy, mixed Aquic Cryoboralfs; fine-loamy, mixed Argic Cryoborolls; and loamy-skeletal, mixed Typic Cryochrepts. The Aquic Cryoboralfs are in depressions and on stream bottoms. They are poorly drained. Their productivity for timber is higher than that of the dominant soils. The Argic Cryoborolls have a thick, dark surface layer. They are in the meadows. The Typic Cryochrepts are underlain by hard sandstone. They are moderately coarse textured. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is near the boundaries of the delineation.

Representative Profile of the Soils

The dominant soils have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Management

Timber

The potential annual production ranges from 52 to 70 cubic feet per acre. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to slough and erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for moose and elk in fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose.

82-2C—Typic Cryoboralfs-Aquic Cryoboralfs complex, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 8,000 to 8,800 feet. The vegetation consists of upper subalpine forest and lower subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on north aspects. They have gradients of 10 to 20 percent. The structurally controlled slopes are roughly parallel to the dip of the underlying bedrock. The slopes generally are widest at the base and gradually taper upward. Also included are small benches and swales having a slope that is not parallel to the dip of the underlying bedrock. Deposits from landslides are in drainageways and near seeps. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation in the forest includes stunted lodgepole pine, whitebark pine, subalpine fir, and Engelmann spruce and scattered areas of mountain meadows. The forests are dense on the lower slopes and open grown on the upper slopes and on ridges. The forest understory is a sparse mat of low-growing shrubs and forbs dominated by grouse whortleberry, heartleaf arnica, and lupine.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type at the mid and higher elevations. Subalpine fir/grouse whortleberry and subalpine fir/heartleaf arnica are the major habitat types at the lower elevations. Whitebark pine/subalpine fir also is in this unit at the highest elevations. A cold climate and low

timber productivity are associated with these habitat types in this unit. These habitat types are in about 85 percent of the unit.

Idaho fescue/bearded wheatgrass, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in the meadows.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of flat, angular rock fragments in the subsoil ranges from 15 to 35 percent. Soil properties vary depending on soil drainage. Both well drained soils and wet soils are in this unit; however, they are not obviously associated with landscape features in the unit.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and fine-loamy, mixed Aquic Cryoboralfs.

The Typic Cryoboralfs are well drained. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 55 percent of the unit.

The Aquic Cryoboralfs are wet and have low strength. They make up about 30 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine-loamy, mixed Argic Pachic Cryoborolls. They have a thick, dark surface layer. They are in the meadows. The rock outcrop is near the boundaries of the delineation.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Aquic Cryoboralfs are light gray silt loam in the upper 4 inches of the surface layer. The lower 3 inches of the surface layer is light brownish gray clay loam. The subsoil is light brownish gray and light gray sandy clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown and grayish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 32 to 50 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate in the upper subalpine forest. Trees commonly are poorly formed and can have spiral grain. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The material exposed on steep cutbanks during road construction tends to slough and erode and is difficult to revegetate because of the harsh climate. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for moose and grizzly bear in summer and fall and for elk in summer. It provides good security cover for mule deer, elk, and moose. If landslides or erosion occurs in this map unit, the sediment can damage the habitat of fish.

84-1A—Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes, northerly aspects

This map unit is on structurally controlled slopes. Elevation ranges from 6,500 to 7,200 feet. The vegetation consists of dense Douglas-fir forest or dense lodgepole pine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on northerly aspects. They have gradients of 10 to 45 percent. The structurally controlled slopes are roughly parallel to the dip of the underlying bedrock. The slopes generally are widest at the base and gradually taper upward. Also included are small benches and swales having a slope that is not parallel to the dip of the underlying bedrock. Deposits from landslides are in drainageways and near seeps. Avalanches occasionally occur in this unit. The landforms have a moderate risk of landslides. The soils

on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

Dense lodgepole pine forest is at the higher elevations, and Douglas-fir forest is at the lower elevations. The mountain meadows are scattered throughout the forested areas. They are on small benches, in valleys, and along drainageways. The forest understory is dominated by snowberry and ninebark at the lower and mid elevations and by blue huckleberry at the higher elevations.

Habitat Types

Subalpine fir/blue huckleberry is the major habitat type at the higher elevations. Douglas-fir/ninebark and Douglas-fir/snowberry are the major habitat types at the lower elevations. Engelmann spruce/ninebark, Engelmann spruce/twinflower, and subalpine fir/virginsbower also are in this unit. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Idaho fescue/bearded wheatgrass, which is a dissimilar habitat type, is in about 15 percent of the unit. It is in the moist meadows.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone. The landslides are associated with shale and with dip slopes.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of subangular rock fragments in the subsoil ranges from 0 to 35 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a somewhat dark surface layer, whereas soils that formed under meadows have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in the forested areas. They have a somewhat dark surface layer. The similar soils have a lighter colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. These dominant and similar soils make up about 70 percent of the unit.

The Argic Cryoborolls are in the meadows. They have a dark surface layer. The similar soils have a slightly thicker, dark surface layer. They are fine-loamy, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 15 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine, mixed Argiaquic Cryoborolls. They are near seeps and springs and along streams. They are somewhat poorly drained and have low strength. The rock outcrop is along the edge of dip slopes.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of loam about 20 inches thick. The upper 10 inches is brown, and the lower 10 inches is light brownish gray. The subsoil is light yellowish brown clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly sandy clay loam and cobbly loam.

Management

Timber

The potential annual production ranges from 47 to 65 cubic feet per acre. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The material exposed on steep cutbanks during road construction tends to slough and erode. Avalanches can increase the cost of maintaining the roads. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The meadows are in about 15 percent of the unit but produce 90 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The invasion of timothy into some of the meadows can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are moderately suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for elk,

moose, and grizzly bear in summer and fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose.

84-1B—Typic Argiborolls, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 6,000 to 7,000 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on south aspects. They have gradients of 10 to 45 percent. The structurally controlled slopes are roughly parallel to the dip of the underlying bedrock. The slopes generally are widest at the base and gradually taper upward. Also included are small benches and swales having a slope that is not parallel to the dip of the underlying bedrock. Deposits from landslides are in drainageways and near seeps. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue. Bluebunch wheatgrass, junegrass, and forbs are in places. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in the understory in moist areas. Scattered areas of Douglas-fir forest are in this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass is the major habitat type in the mountain grassland. Big sagebrush/ Idaho fescue is the major habitat type in the mountain shrubland. A warm, dry climate and moderate forage productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 15 percent of the forested areas of the map unit. Douglas-fir/ninebark is at the lower elevations. Engelmann spruce habitat types are in moist areas along streams. They have an understory of forbs.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone. The landslides are associated with some of the shale formations.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured surface layer and an accumulation of clay in the subsoil. The content of subangular rock fragments in the subsoil ranges from 0 to 15 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Argiborolls. They have a dark surface layer. The similar soils have a thicker, dark surface layer. They are fine-loamy, mixed Pachic Argiborolls. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the map unit. The dissimilar soils are loamy-skeletal, mixed Typic Haploborolls and loamy-skeletal, mixed Typic Ustochrepts. They are on ridges that are underlain by sandstone. They do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is along the edge of dip slopes.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown sandy loam about 14 inches thick. The upper part of the subsoil is yellowish brown gravelly sandy clay loam about 4 inches thick. The lower part is yellowish brown and light yellowish brown cobbly sandy clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is light brownish gray and brownish yellow stony sandy clay loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,635 to 1,820 pounds per acre of air-dry herbage in a normal year. Livestock prefer the vegetation in moist areas along streams. As a result, they tend to gather in these areas. In places controlling

the sagebrush improves forage production. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. Productivity of the forest understory increases after timber harvest. The forested areas are well suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for mule deer and elk in fall and winter. It also can provide good habitat for blue grouse.

84-2B—Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 6,400 to 7,000 feet. The vegetation consists of lower subalpine forest and mountain grassland. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 20 percent. The structurally controlled slopes are roughly parallel to the dip of the underlying bedrock. The slopes generally are widest at the base and gradually taper upward. Also included are small benches and swales having a slope that is not parallel to the dip of the underlying bedrock. Deposits from landslides are in drainageways and near seeps. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

Dense lodgepole pine forest is at the higher elevations, and Douglas-fir forest is at the lower elevations. The mountain grassland is on small benches or along drainageways. The forest understory is dominated by shrubs on north-facing slopes and by grasses and forbs on south-facing slopes. Blue huckleberry is dominant on north-facing slopes, and pinegrass is dominant on south-facing slopes. The mountain grassland is dominated by Idaho fescue and bluebunch wheatgrass. Big sagebrush is in the drier areas, and taller grasses are in the moister areas. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Subalpine fir/blue huckleberry is the major habitat type on north-facing slopes, and subalpine fir/pinegrass is the major habitat type on south-facing slopes. Subalpine fir/heartleaf arnica also is at the higher elevations. A cool, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 55 percent of the unit. Idaho fescue/bluebunch wheatgrass is the major habitat type in the mountain grassland. Idaho fescue/bearded wheatgrass also is in areas of this grassland. Moderate forage productivity is associated with these habitat types in this unit. These habitat types are in about 20 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Douglas-fir/snowberry and Douglas-fir or limber pine habitat types are at the lower elevations on south-facing slopes. They have an understory of bunchgrass. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by thick beds of dark sandstone interbedded with thin beds of shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under dense forest have a somewhat dark surface layer, whereas soils that formed under mountain grassland have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in areas of the dense forest. They have a somewhat dark surface layer. They make up about 70 percent of the unit.

The Argic Cryoborolls are in areas of the mountain grassland. They have a dark surface layer. The similar soils have a slightly thicker, dark surface layer. They are loamy-skeletal, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 20 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 10 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts. They are in areas near the rock outcrop. They have a light colored surface layer. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is near the boundaries of the delineation.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam to very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production ranges from 48 to 69 cubic feet per acre. The terrain is well suited to the operation of tractors.

Roads

Unsurfaced roads are slick when wet.

Range

The mountain grassland is in about 20 percent of the unit but produces 80 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The average production for the potential native plant communities in the mountain grassland is about 1,635 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall and for moose and elk in fall and winter. It also can provide good habitat for blue grouse in summer and fall. It provides good security cover for mule deer and elk.

85-2A—Typic Calciborolls-Rock outcrop-Typic Ustochrepts complex, limestone substratum, steep

This map unit is on structurally controlled slopes. Elevations range from 6,800 to 8,200 feet. The vegetation consists of open-grown forest on south-facing slopes and dense Douglas-fir forest on north-facing slopes. The soils formed in material weathered from limestone.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes are strongly affected by the dip in the underlying bedrock. The Rock outcrop generally forms prominent cliffs, which are picturesque. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The understory in the dense Douglas-fir forest is dominated by shrubs. Blue huckleberry is at the highest elevations. Ninebark and snowberry are at the mid and lower elevations. The understory in the open-grown Douglas-fir forest is dominated by bunchgrass. Idaho fescue and bluebunch wheatgrass are also included. Trees in this unit tend to be short and poorly formed, especially on south-facing slopes at the lower elevations.

Habitat Types

Douglas-fir/Idaho fescue is the major habitat type in the open-grown forest. Idaho fescue/bluebunch wheatgrass also is in the open-grown forest. These habitat types are in about 40 percent of the unit. Douglas-fir/snowberry and Douglas-fir/ninebark are the major habitat types in the dense Douglas-fir forest. Douglas-fir/virginsbower also is in the dense Douglas-fir forest. These habitat types are in about 25 percent of the unit. A warm, dry climate and low or moderate timber productivity are associated with these habitat types in this unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir and Engelmann spruce habitat types are on north-facing slopes. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit dominantly is underlain by thick beds of limestone. It is underlain by calcareous sandstone in places.

Characteristics of the Soils

The soils in this map unit have a medium textured or moderately fine textured surface layer. The content of subangular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary according to the aspect of the soils. Soils on south-facing slopes have a dark surface layer, whereas soils on north-facing slopes have a light colored surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, carbonatic Typic Calciborolls and loamy-skeletal, mixed, frigid Typic Ustochrepts.

The Typic Calciborolls are on south-facing slopes. They make up about 40 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 25 percent of the unit.

The Typic Ustochrepts are on north-facing slopes. They make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Typic Eutroboralfs and loamy-skeletal, mixed Mollic Eutroboralfs. They are on north-facing slopes under dense subalpine fir forest and Engelmann spruce forest. They have an accumulation of clay in the subsoil and are moderately fine textured. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Calciborolls have a surface layer of calcareous, dark grayish brown very gravelly silt loam about 20 inches thick. The subsoil is calcareous, pale brown very gravelly loam about 7 inches thick. The substratum to a depth of 60 inches or more is calcareous, very pale brown extremely cobbly sandy loam.

The Typic Ustochrepts have a surface layer of light brownish gray clay loam and gravelly clay loam. The surface layer is about 6 inches thick. The upper part of the subsoil is brown very gravelly clay loam about 2 inches thick. The lower part is yellowish red very cobbly sandy clay loam about 11 inches thick. The substratum to a depth of 60 inches or more is calcareous, light reddish brown very cobbly clay loam.

Management

Timber

The potential annual production ranges from 16 to 26 cubic feet per acre on south-facing slopes and from 36 to 50 cubic feet per acre on north-facing slopes. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by moisture stress and by plant competition in the open-grown forest. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The slope limits access to forage. Livestock tend to gather in the less sloping areas. The forest understory on south-facing slopes produces a moderate amount of forage. Forage production increases following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer, fall, and winter. It also can provide good habitat for blue grouse in spring and good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer, elk, and moose.

85-2B—Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, calcareous substratum

This map unit is on structurally controlled slopes. Elevation ranges from 6,000 to 7,500 feet. The vegetation consists of lower subalpine forest and dense Douglas-fir forest. The soils formed in material weathered from limestone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by limestone and small benches and saddles that are underlain by shale, siltstone, or mudstone. Snow avalanches occasionally occur in this unit during winter and spring. Slope and relief are strongly affected by the dip of the underlying bedrock. Only the landforms that are underlain by shale are subject to landslides. The soils on all of the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

Dense lodgepole pine forest is at the higher elevations, and Douglas-fir forest is at the lower elevations. Scattered areas of mountain grassland are in the forests. The forest understory is shrubs dominated by virginsbower, blue huckleberry, snowberry, and ninebark. Snowberry and ninebark dominate the understory in the Douglas-fir forest.

Habitat Types

Subalpine fir/virginsbower and subalpine fir/blue huckleberry are the major habitat types at the higher elevations. These habitat types are in about 45 percent of the unit. Douglas-fir/snowberry and Douglas-fir/ ninebark are the major habitat types at the lower

elevations. Engelmann spruce/ninebark also is at the lower elevations. These habitat types are in about 30 percent of the unit. A warm, moist climate and low or moderate timber productivity are associated with these habitat types in this unit.

Idaho fescue/bluebunch wheatgrass, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in areas of the mountain grassland.

Geology

This map unit is underlain by thick beds of limestone and calcareous sandstone interbedded with shale, siltstone, or mudstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the topography. Soils on benches or in saddles have an accumulation of clay in the subsoil, whereas soils on ridges do not have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs are on benches or in saddles. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are loamy-skeletal, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 40 percent of the unit.

The Typic Cryochrepts are on ridges. They are 20 to 40 inches deep over bedrock. The similar soils are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed Lithic Cryochrepts. These dominant and similar soils make up about 35 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 15 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine, mixed Typic Cryoboralfs. They are on saddles and benches. They are fine textured. The content of rock fragments in the subsoil ranges from 10 to 35 percent. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 29 inches thick. The lower part is pale brown very stony clay loam about 12 inches thick. The substratum to a depth of 60 inches or more is very pale brown very stony loam.

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is calcareous, very pale brown very cobbly loam about 13 inches thick. The substratum is calcareous, very pale brown very cobbly loam. Limestone bedrock is at a depth of about 32 inches.

Management

Timber

The potential annual production ranges from 34 to 52 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by moisture stress. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

The slope increases the amount of material excavated during road construction. Hard rock limits excavation in places. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer. It also can provide good habitat for blue grouse in summer and fall. It provides good security cover for mule deer, elk, and moose.

85-3A—Mollic Cryoboralfs-Argic Cryoborolls-Rock outcrop complex, structurally controlled slopes, steep

This map unit is on structurally controlled slopes. Elevation ranges from 6,300 to 7,200 feet. The vegetation consists of dense Douglas-fir forest on north-facing slopes and mountain grassland and mountain shrubland on south-facing slopes. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale. Slope and relief are

strongly affected by the dip of the underlying bedrock. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The dense Douglas-fir forest has an understory dominated by shrubs. Snowberry is the most common shrub. The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory dominated by Idaho fescue and forbs. Sticky geranium and a variety of forbs and grasses are in moist areas. Open-grown Douglas-fir forest and limber pine forest are on south-facing slopes. Douglas-fir seedlings invade the grassland and shrubland in places.

Habitat Types

Douglas-fir/snowberry is the major habitat type in the dense Douglas-fir forest. A warm, dry climate and low timber productivity are associated with the forest habitat types in this unit. These habitat types are in about 40 percent of the unit. Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types in the mountain grassland and mountain shrubland. Idaho fescue/bearded wheatgrass also is in areas of the mountain grassland and mountain shrubland. Moderate forage productivity is associated with the grassland and shrubland habitat types. These habitat types are in about 30 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/blue huckleberry is on north-facing slopes at the higher elevations. Its productivity for timber is higher than that of the major habitat types. Douglas-fir/Idaho fescue and limber pine habitat types are on south-facing slopes. They have an understory of bunchgrass. Their productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by thick beds of dark sandstone interbedded with thin beds of shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary according to the aspect of the soils. Soils on north-facing slopes have a somewhat dark surface layer, whereas soils on south-facing slopes have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are on north-facing slopes. They have a somewhat dark surface layer. The similar soils have a lighter colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs. These dominant and similar soils make up about 35 percent of the unit.

The Argic Cryoborolls are on south-facing slopes. They make up about 35 percent of the unit.

The Rock outcrop is on ridgetops and the steeper side slopes. It makes up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Lithic Cryochrepts. They are near ridgetops or areas of sandstone outcrops. They are moderately coarse textured and do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam to very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production ranges from 26 to 64 cubic feet per acre. Productivity is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by moisture stress and plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average.

Roads

The slope increases the amount of material excavated during road construction. Unsurfaced roads are slick when wet. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The mountain grassland and mountain shrubland are in about 30 percent of the unit but produce 80 percent of the forage. Because the forage is in widely scattered areas and because of the slope, however, access to the forage is limited. The forest understory produces a limited amount of forage.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer, fall, and winter. It also can provide good habitat for blue grouse in summer and fall and good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

85-3B—Mollic Cryoboralfs-Argic Cryoborolls complex, structurally controlled slopes, steep

This map unit is on structurally controlled slopes. Elevation ranges from 6,600 to 7,800 feet. The vegetation consists of lower subalpine forest and dense Douglas-fir forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. Avalanches occasionally occur in this unit. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation dominantly is dense lodgepole pine forest and dense Douglas-fir forest. The forest understory is a dense mat of shrubs on north-facing slopes. It is dominated by blue huckleberry. It is dominantly grasses and forbs on south-facing slopes. The grasses and forbs are dominated by pinegrass. Scattered areas of mountain grassland and mountain shrubland also are in this unit.

Habitat Types

Subalpine fir/blue huckleberry is the major habitat type on north-facing slopes. Subalpine fir/grouse whortleberry also is on north-facing slopes. Subalpine fir/pinegrass and Douglas-fir/snowberry are the major habitat types on south-facing slopes. A cool or warm, moist climate and moderate timber productivity are associated with these habitat types in this unit. These habitat types are in about 80 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Big sagebrush/Idaho fescue is in areas of the mountain shrubland, and Idaho fescue/bluebunch wheatgrass is in areas of the mountain grassland.

Geology

These soils are underlain by thick beds of dark sandstone interbedded with thin beds of shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary according to the aspect of the soils. Soils on north-facing slopes have a somewhat dark surface layer, whereas soils on south-facing slopes have a dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are on north-facing slopes. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs. These dominant and similar soils make up about 60 percent of the unit.

The Argic Cryoborolls are on south-facing slopes. They have a dark surface layer. They make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Lithic Cryochrepts. They are near ridgetops and in areas near sandstone outcrops. They are moderately coarse textured and do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is on ridgetops and side slopes.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale

brown and very pale brown very stony loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam to very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production ranges from 53 to 69 cubic feet per acre in the subalpine forest and from 36 to 64 cubic feet per acre in the dense Douglas-fir forest. The slope limits the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. Regeneration of the dense Douglas-fir forest is limited by moisture stress.

Roads

The slope increases the amount of material excavated during road construction. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are slick when wet.

Range

The mountain grassland and mountain shrubland are in about 10 percent of the unit but produce 90 percent of the available forage. Because the forage is in widely scattered areas and because of the slope, however, access to the forage is limited. The forest understory produces a limited amount of forage. Forage production increases following timber harvest.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall. It also provides good habitat for blue grouse in summer and fall. It provides good security cover for mule deer and moose. If the soils in this unit are subject to erosion, the eroded sediment can damage the habitat of fish.

86-2A—Typic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 6,800 to 8,000 feet. The vegetation consists of lower subalpine forest and mountain meadows. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 45 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. About 20 to 40 percent of the unit is subject to landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine and subalpine fir forest and large areas of mountain meadows. The forest understory is a thick mat of shrubs dominated by blue huckleberry, twinflower, and grouse whortleberry. Heartleaf arnica, virginsbower, and pinegrass also are in the forested areas. The vegetation in the mountain meadows includes bearded wheatgrass, mountain brome, timber oatgrass, sticky geranium, and forbs. Big sagebrush forms a dense overstory in places.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/twinflower are the major habitat types in the forested areas. Subalpine fir/heartleaf arnica, subalpine fir/grouse whortleberry, and Engelmann spruce habitat types also are in the forested areas. A cool, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 45 percent of the unit. Idaho fescue/bearded wheatgrass is the major habitat type in the mountain meadows. Big sagebrush/Idaho fescue and Idaho fescue/bluebunch wheatgrass also are in the meadows. A cool, moist climate and high forage productivity are associated with these habitat types in this unit. These habitat types are in about 30 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Douglas-fir habitat types are at the lower elevations. Regeneration of the forest is more difficult at the lower elevations.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 20 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a light colored surface layer, whereas soils that formed under mountain meadows have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Typic Cryoboralfs are in the forested areas. They have a light colored surface layer. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 40 percent of the unit.

The Argic Cryoborolls are in the mountain meadows. They have a dark surface layer. They make up about 40 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts. They are in areas near sandstone outcrops. They have a 35 to 60 percent content of rock fragments in the subsoil and do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 53 to 69 cubic feet per acre in the forested areas. Timber productivity in the map unit is limited by the mountain meadows. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities in the mountain meadows is about 2,225 pounds per acre of air-dry herbage in a normal year. The mountain meadows are in about 30 percent of the unit but produce more than 90 percent of the available forage. The invasion of timothy into the meadows can alter the grazing season and affect utilization of the forage. The forest understory provides a limited amount of forage. Forage production increases after timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk and moose in summer and fall and for grizzly bear in summer. It provides good security cover for mule deer, elk, and moose.

86-2C—Argic Cryoborolls, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 45 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. About 20 to 40 percent of the unit is subject to landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland contains big sagebrush. Its understory is dominated by Idaho fescue. Bluebunch wheatgrass, junegrass, and forbs are common in this unit. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are common in moist areas. Scattered areas of forest are in this unit. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types. Idaho fescue/bearded wheatgrass is in depressions. A

warm, dry climate and moderate forage productivity are associated with these habitat types. These habitat types are in about 85 percent of the unit.

Subalpine fir/grouse whortleberry, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in the scattered areas of forest.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 20 percent.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls. They have a dark surface layer and a moderately fine textured subsoil. The similar soils have a thicker, dark surface layer or a fine textured subsoil. They are fine-loamy Argic Pachic Cryoborolls and fine, mixed Argic Cryoborolls. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and fine-loamy, mixed Typic Cryoboralfs. The Typic Cryochrepts are in areas near the rock outcrop. They have a 35 to 60 percent content of rock fragments in the subsoil and do not have an accumulation of clay in the subsoil. Their productivity for forage is lower than that of the dominant soils. The Typic Cryoboralfs are in forested areas. They have a light colored surface layer. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The dominant soils have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,635 to 1,820 pounds per acre of air-dry herbage in a normal year. Delaying grazing until the soils have dried out helps to prevent the damage caused by trampling. In places controlling the sagebrush improves forage production. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall, for elk in fall and winter, and for grizzly bear in spring.

86-2D—Typic Cryoboralfs-Mollic Cryoboralfs complex, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 6,800 to 7,800 feet. The vegetation consists of lower subalpine forest and upper subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 45 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. Seeps and springs are in some swales and on some benches. About 20 to 40 percent of the unit is subject to landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is mainly dense lodgepole pine forest, subalpine fir forest, and scattered areas of mountain meadows. The forest at the higher elevations contains whitebark pine. The forest understory is a thick mat of shrubs dominated by blue huckleberry, twinflower, and grouse whortleberry. Beargrass and pinegrass are in places.

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/grouse whortleberry are the major habitat types at the lower elevations. Subalpine fir/twinflower, subalpine fir/heartleaf arnica, subalpine fir/pinegrass, and subalpine fir/beargrass also are at the lower elevations. A cool climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 60 percent of the unit. Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type at the

higher elevations. Low timber productivity is associated with this habitat type. This habitat type is in about 15 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Idaho fescue/bearded wheatgrass is in the mountain meadows. Douglas-fir/blue huckleberry is at the lower elevations. Regeneration of the forest at the lower elevations is limited by moisture stress.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 0 to 50 percent. Soils are not obviously associated with landscape features in this unit.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and loamy-skeletal, mixed Mollic Cryoboralfs.

The Typic Cryoboralfs have a light colored surface layer and are moderately fine textured in the lower part of the subsoil. The similar soils have a fine textured subsoil. They are fine, mixed Typic Cryoboralfs. These dominant and similar soils make up about 60 percent of the unit.

The Mollic Cryoboralfs have a somewhat dark surface layer. They have a 35 to 50 percent content of rock fragments in the subsoil. The similar soils have a 0 to 35 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 30 percent of the unit.

Dissimilar soils and rock outcrop make up about 10 percent of the unit. The dissimilar soils are fine, mixed Aquic Cryoboralfs and Argiaquic Cryoborolls. The Aquic Cryoboralfs are near seeps and springs. They have a light colored surface layer. Their productivity for timber is higher than that of the dominant soils. The Argiaquic Cryoborolls have a dark surface layer. They are in the mountain meadows. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

Management

Timber

The potential annual production is 53 to 71 cubic feet per acre in the lower subalpine forest and less than 20 cubic feet per acre in the upper subalpine forest. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. The material exposed on steep cutbanks during road construction tends to slough and erode. Providing suitable subgrade material helps to prevent the damage caused by wetness. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory provides a limited amount of forage. Forage production increases after timber harvest. The forested areas are moderately suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk and moose in summer and fall and for grizzly bear in summer. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose.

86-2E—Argic Cryoborolls-Mollic Cryoboralfs complex, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 7,000 to 8,000 feet. The vegetation consists of mountain meadows and upper subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 30 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone.

Slope and relief are strongly affected by the dip of the underlying bedrock. Seeps and springs are in wet meadows. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

Whitebark pine, subalpine fir, Engelmann spruce, and lodgepole pine are in the forested areas. Most of the trees are stunted and deformed. The forest understory is a dense mat of shrubs dominated by grouse whortleberry. Heartleaf arnica and other forbs also are in the forested areas. The vegetation in the mountain meadows includes bearded wheatgrass, mountain brome, timber oatgrass, and forbs. Sticky geranium is in the moister areas. Scattered areas of wet meadows also are in this unit.

Habitat Types

Idaho fescue/bearded wheatgrass is the major habitat type in the mountain meadows. High forage productivity is associated with this habitat type in this unit. This habitat type is in about 45 percent of the unit. Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type in the forested areas. Whitebark pine/subalpine fir also is in these areas. Very low timber productivity is associated with this habitat type in this unit. These habitat types are in about 35 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/grouse whortleberry and subalpine fir/heartleaf arnica are at the lower elevations. Their productivity for timber is higher than that of the major habitat types. Tufted hairgrass/sedge is in the wet meadows.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 30 percent. Soil properties vary depending on the vegetation. Soils that formed under mountain meadows have a dark surface layer, whereas soils that formed under forest have a somewhat dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and fine-loamy, mixed Mollic Cryoboralfs.

The Argic Cryoborolls are in the mountain meadows. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are fine-loamy, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 45 percent of the unit.

The Mollic Cryoboralfs are in the forested areas. They have a somewhat dark surface layer and a subsoil of clay loam. The similar soils have a light colored surface layer or a subsoil of clay that is underlain by sandstone and shale. They are fine-loamy, mixed Typic Cryoboralfs and fine, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and Cryaquolls. The Typic Cryochrepts are in areas near sandstone outcrops. They do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The Cryaquolls are in wet meadows. They are somewhat poorly drained and have low strength. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

Management

Timber

The potential annual production is less than 20 cubic feet per acre in the forested areas. Productivity in the map unit is limited by the mountain meadows. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by the harsh climate. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The material exposed on steep

cutbanks during road construction tends to slough and erode and is difficult to revegetate because of the harsh climate. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities in the mountain meadows is about 2,225 pounds per acre of air-dry herbage in a normal year. Early and late snowfalls in summer commonly shorten the length of the grazing season. Delaying grazing until the soils have dried out helps to prevent the damage caused by trampling. Loose herding of sheep is particularly important for proper forage utilization. The invasion of timothy into some of the meadows can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk, moose, and grizzly bear in summer and fall. It also provides good habitat for blue grouse in fall and winter. It provides good security cover for mule deer, elk, and moose.

86-3B—Typic Cryoboralfs-Mollic Cryoboralfs complex, structurally controlled slopes, warm

This map unit is on structurally controlled slopes. Elevation ranges from 5,500 to 7,000 feet. The vegetation consists of lower subalpine forest and dense Douglas-fir forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 30 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is mainly lodgepole pine forest. Some areas of Douglas-fir forest are at the lower elevations on south-facing slopes. On north-facing slopes the forest understory is a dense mat of shrubs dominated by grouse whortleberry, blue huckleberry, and twinflower. On south-facing slopes at the lower elevations, it is dominated by snowberry, pinegrass, and elk sedge. Some areas of mountain grassland are in the unit.

Habitat Types

Subalpine fir/grouse whortleberry, subalpine fir/blue huckleberry, and subalpine fir/twinflower are the major habitat types at the higher elevations. A cool, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 60 percent of the unit. Douglas-fir/snowberry is the major habitat type at the lower elevations on south-facing slopes. A warm, moist climate and moderate timber productivity are associated with this habitat type. This habitat type is in about 25 percent of the unit.

Idaho fescue/bluebunch wheatgrass, which is a dissimilar habitat type, is in about 10 percent of the unit. It is on south-facing slopes in areas of the mountain grassland.

Geology

These soils are underlain by thick beds of dark sandstone interbedded with thin beds of shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 5 to 35 percent. Soil properties vary according to the aspect of the soils. Soils on north-facing slopes have a light colored surface layer, whereas soils on south-facing slopes have a somewhat dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and fine-loamy, mixed Mollic Cryoboralfs.

The Typic Cryoboralfs are on north-facing slopes. They have a light colored surface layer and are moderately fine textured in the lower part of the subsoil. The similar soils are fine textured in the lower part of the subsoil. They are fine, mixed Typic Cryoboralfs. These dominant and similar soils make up about 60 percent of the unit.

The Mollic Cryoboralfs are on south-facing slopes. They have a somewhat dark surface layer and are moderately fine textured in the lower part of the subsoil. The similar soils are fine textured in the lower part of the subsoil. They are fine, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 25 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are fine-loamy, mixed Argic Cryoborolls. They are in areas of the

mountain grassland. They have a dark surface layer. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

Management

Timber

The potential annual production ranges from 53 to 69 cubic feet per acre in the lower subalpine forest and from 48 to 64 cubic feet per acre in the dense Douglas-fir forest. The terrain is well suited to the operation of tractors.

Roads

The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for blue grouse in fall. It provides good security cover for mule deer, elk, and moose.

86-3C—Argic Cryoborolls-Typic Cryoborolls association, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 5,500 to 7,000 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 10 to 45 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland contains big sagebrush and has an understory dominated by Idaho fescue and forbs. Bluebunch wheatgrass and junegrass also are in places. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are in moist areas. Douglas-fir seedlings invade the mountain grassland and mountain shrubland in places. Scattered areas of Douglas-fir forest are in this unit.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types. Douglas-fir/Idaho fescue also is in this unit. A warm, moist climate and moderate forage productivity are associated with these habitat types. These habitat types are in about 85 percent of the unit.

Douglas-fir/snowberry, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in isolated stands of forest, generally near the boundaries of the delineation.

Geology

These soils are underlain by thick beds of dark sandstone interbedded with thin beds of shale and siltstone. Volcanic rocks are in places.

Characteristics of the Soils

The soils in this map unit have a medium textured or moderately coarse textured surface layer. The content of rock fragments in the subsoil ranges from 10 to 50 percent. Soil properties vary depending on the underlying bedrock. Soils underlain by shale have a moderately fine textured subsoil and an accumulation of clay in the subsoil, whereas soils underlain by sandstone have a moderately coarse textured subsoil and do not have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and loamy-skeletal, mixed Typic Cryoborolls.

The Argic Cryoborolls are underlain by shale. They have a dark surface layer and a 10 to 35 percent content of rock fragments in the subsoil. The similar soils have a thicker, dark surface layer or a 35 to 50 percent content of rock fragments in the subsoil. They are fine-loamy, mixed Argic Pachic Cryoborolls and

loamy-skeletal, mixed Argic Cryoborolls. The dominant and similar soils make up about 65 percent of the unit.

The Typic Cryoborolls are underlain by sandstone. They make up about 25 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 10 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Lithic Cryochrepts. They are in areas near the rock outcrop. They have a light colored surface layer or bedrock within 20 inches of the surface. Their productivity for forage is lower than that of the dominant soils. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

The Typic Cryoborolls have a surface layer of dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is dark grayish brown very gravelly sandy loam about 9 inches thick. The lower part is dark grayish brown very cobbly sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly sandy loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The material exposed on steep cutbanks during road construction tends to erode. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities is about 1,728 pounds per acre of air-dry herbage in a normal year. Grazing should be delayed until the soils have sufficiently dried out and are firm enough to withstand trampling by livestock. In places controlling the sagebrush improves production of desirable forage plants. The invasion of timothy into some of the mountain grassland can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall.

87-1A—Rock outcrop-Typic Cryochrepts-Typic Cryoborolls complex, limestone substratum

This map unit is on structurally controlled slopes. Elevation ranges from 7,800 to 8,800 feet. The vegetation consists of timberline forest and alpine meadows. The soils formed in material weathered from limestone and sandstone.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes are hogback ridges. They are roughly parallel to the dip of the underlying bedrock. The slopes generally are widest at the base and gradually taper upward. Exposed bedrock forms cliffs and ledges. Avalanche paths are in some places. Rockslides frequently occur in this map unit. The soils on the landforms have moderate water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is an open-grown forest of whitebark pine and subalpine fir and alpine meadows. It is in scattered areas of the Rock outcrop and rubble land. Trees commonly are deformed and stunted. The forest understory is a sparse mat of forbs and shrubs dominated by grouse whortleberry. The alpine meadows contain grasses and forbs, which are rarely more than 6 inches in height. Idaho fescue, tufted hairgrass, bearded wheatgrass, alpine bluegrass, and sedges are common.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type in the forested areas. Whitebark pine/subalpine fir is at the higher elevations in the forested areas. A cold climate and very low timber productivity are associated with these habitat types. These habitat types are in about 25 percent of the unit. Idaho fescue/tufted hairgrass is the major habitat type in the alpine meadows. A cold climate and moderate forage productivity are associated with this habitat type. This habitat type is in about 20 percent of the unit.

Subalpine fir habitat types, which are dissimilar habitat types, are in about 5 percent of the unit. They are in shallow draws and at the base of slopes in densely forested areas. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit is underlain by thick beds of limestone or calcareous sandstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 70 percent. Soil properties vary depending on the vegetation. Soils that formed under timberline forest have a light colored surface layer, whereas soils that formed under alpine meadows have a dark surface layer.

Map Unit Composition

The Rock outcrop is in areas throughout this map unit. Rubble land is a similar component in the unit. The Rock outcrop and rubble land make up about 50 percent of the unit.

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Typic Cryoborolls.

The Typic Cryochrepts are in areas of the timberline forest. They are 20 to 40 inches deep over bedrock. The similar soils are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed Lithic Cryochrepts. These dominant and similar soils make up about 30 percent of the unit.

The Typic Cryoborolls are in the alpine meadows. They do not have an accumulation of clay in the subsoil. The similar soils have an accumulation of clay in the subsoil. They are loamy-skeletal, mixed Argic Cryoborolls. These dominant and similar soils make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is calcareous, very pale brown very cobbly loam about 13 inches thick. The substratum to a depth of 60 inches or more is calcareous, very pale brown extremely cobbly loam.

The Typic Cryoborolls have a surface layer of dark grayish brown loam about 7 inches thick. The upper part of the subsoil is dark grayish brown very gravelly loam about 9 inches thick. The lower part is dark grayish brown very cobbly loam about 6 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly loam.

Management

Timber

The potential annual production is less than 20 cubic feet per acre. Timber productivity in the map unit is limited by the Rock outcrop and the alpine meadows. The slope and the Rock outcrop limit the operation of tractors. Regeneration of the forest is limited by the harsh climate.

Roads

The slope increases the amount of material excavated during road construction. Hard rock occasionally limits excavation. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of the harsh climate and moisture stress.

Range

The average production for the potential native plant communities in the alpine meadows is about 1,300 pounds per acre of air-dry herbage in a normal year. The slope and the Rock outcrop limit access by livestock. The length of the grazing season is short. The forest understory provides a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit can provide good habitat for elk and grizzly bear in summer and fall. It also can provide good nesting habitat for raptors that nest on cliffs. It provides good security cover for mule deer and elk.

87-1B—Typic Calciborolls-Typic Argiborolls-Rock outcrop complex, steep

This map unit is on structurally controlled slopes. Elevation ranges from 5,800 to 7,800 feet. The vegetation consists of mountain grassland and mountain shrubland. The soils formed in material weathered from limestone.

Landform

The dominant slopes are on south aspects. They have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by sandstone or limestone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. Avalanches occasionally occur in this unit. The soils on the landforms have low water-holding capacity, and most of the surface runoff occurs when snow melts.

Vegetation

The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland contains big sagebrush. Its understory is dominated by Idaho fescue and forbs. Scattered stands of Douglas-fir are in this unit. Douglas-fir seedlings invade the grassland and the shrubland in places.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types. Douglas-fir/Idaho fescue also is in this unit. A warm climate and moderate forage productivity are associated with these habitat types. These habitat types are in about 75 percent of the unit.

Douglas-fir/snowberry, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in the scattered areas of Douglas-fir.

Geology

This map unit dominantly is underlain by thick beds of limestone. It is underlain by calcareous sandstone and thin beds of shale in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the underlying bedrock. Soils that formed in material weathered from limestone have a very high content of lime in the subsoil, whereas soils that formed in material weathered from sandstone and shale have a lower content of lime in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, carbonatic Typic Calciborolls and loamy-skeletal, mixed Typic Argiborolls.

The Typic Calciborolls formed in material weathered from limestone. They make up about 40 percent of the unit.

The Typic Argiborolls formed in material weathered from sandstone and shale. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are loamy-skeletal, mixed Pachic Argiborolls. These dominant and similar soils make up about 30 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Mollic Eutroboralfs and loamy-skeletal, mixed Typic Ustochrepts. The Mollic Eutroboralfs are in the scattered areas of Douglas-fir. The Typic Ustochrepts are near areas of the Rock outcrop. They have a light colored surface layer. Their productivity for forage is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Calciborolls have a surface layer of dark grayish brown very gravelly silt loam about 8 inches thick. The subsoil is calcareous, grayish brown very gravelly loam about 19 inches thick. The substratum to a depth of 60 inches or more is calcareous, very pale brown very cobbly sandy loam.

The Typic Argiborolls have a surface layer of very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 6 inches thick. The lower part is light yellowish brown very gravelly silty clay loam about 4 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly silt loam.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The slope increases the amount of material excavated during road construction. Hard rock occasionally limits excavation. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The average production for the potential native plant communities is about 1,245 to 1,408 pounds per acre of air-dry herbage in a normal year. The slope, the Rock outcrop, and insufficient water for livestock are limitations affecting range. Building drift fences, herding, and locating salting facilities away from the water help to overcome these limitations.

Wildlife and fisheries

This map unit can provide good nesting habitat for raptors that nest on cliffs.

87-1D—Typic Cryochrepts-Typic Cryoboralfs-Rock outcrop complex, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 6,700 to 7,500 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from limestone.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by limestone or sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly

affected by the dip of the underlying bedrock. Avalanches occasionally occur in this unit. The soils on the landforms have low water-holding capacity, and surface runoff occurs when snow melts.

Vegetation

The vegetation dominantly is dense lodgepole pine forest. The forest understory is a dense mat of blue huckleberry, twinflower, or virginsbower. Scattered areas of mountain meadows also are in this unit

Habitat Types

Subalpine fir/blue huckleberry and subalpine fir/ twinflower are the major habitat types at the low and mid elevations. Subalpine fir/virginsbower is the major habitat type at the higher elevations. Subalpine fir/ grouse whortleberry also is in this unit. A cool, moist climate and low timber productivity are associated with these habitat types. These habitat types are in about 75 percent of the unit.

Idaho fescue/tufted hairgrass, which is a dissimilar habitat type, is in about 5 percent of the unit. It is in the mountain meadows.

Geology

This map unit dominantly is underlain by thick beds of limestone. It is underlain by calcareous sandstone and thin beds of shale in places.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the underlying bedrock. Soils underlain by limestone and sandstone do not have an accumulation of clay in the subsoil, whereas soils underlain by shale have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts and loamy-skeletal, mixed Typic Cryoboralfs.

The Typic Cryochrepts are underlain by limestone and sandstone. They are 20 to 40 inches deep over bedrock. The similar soils are 4 to 20 inches deep over bedrock. They are loamy-skeletal, mixed Lithic Cryochrepts. These dominant and similar soils make up about 45 percent of the unit.

The Typic Cryoboralfs are underlain by shale. They make up about 30 percent of the unit.

The Rock outcrop is on ridges. Rubble land is a similar component in this unit. The Rock outcrop and rubble land make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 5 percent of the unit. They are loamy-skeletal, mixed Argic Cryoborolls. They have a dark surface layer. They are in the mountain meadows.

Representative Profile of the Soils

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is calcareous, very pale brown very cobbly loam about 13 inches thick. The substratum to a depth of 60 inches or more is calcareous, very pale brown very cobbly loam.

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 29 inches thick. The lower 12 inches is pale brown very stony loam to clay loam. The substratum to a depth of 60 inches or more is very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 40 to 52 cubic feet per acre. Productivity in the map unit is limited by the Rock outcrop. The slope affects the operation of tractors. Regeneration of the forest is limited by moisture stress and plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

The slope increases the amount of material excavated during road construction. Hard rock occasionally limits excavation. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones. The material exposed during road construction is difficult to revegetate because of moisture stress.

Range

The forest understory provides a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose.

87-2A—Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes, steep

This map unit is on structurally controlled slopes. Elevation ranges from 5,800 to 7,800 feet. The

vegetation consists of open-grown forest and mountain grassland. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on south aspects. They have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. Avalanches occasionally occur in this unit. About 20 to 40 percent of the unit is subject to landslides. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs occasionally.

Vegetation

The open-grown forest contains stunted Douglas-fir and limber pine. It has an understory of bunchgrass. The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. Douglas-fir seedlings commonly invade the mountain grassland.

Habitat Types

Douglas-fir/Idaho fescue is the major habitat type in the open-grown forest. Limber pine habitat types that have a grassy understory also are in the open-grown forest. A warm, dry climate and low timber productivity are associated with these habitat types. These habitat types are in about 65 percent of the unit. Idaho fescue/ bluebunch wheatgrass is the major habitat type in the mountain grassland. Big sagebrush/Idaho fescue also is in the mountain grassland. Moderate forage productivity is associated with these habitat types. These habitat types are in about 30 percent of the unit.

Douglas-fir/snowberry, which is a dissimilar habitat type, is in about 5 percent of the unit. It is on north-facing slopes. Its productivity for timber is higher than that of the major habitat types.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 0 to 20 percent. Soil properties vary depending on the vegetation. Soils that formed under open-grown forest have a somewhat dark surface layer, whereas soils that formed under mountain grassland have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in areas of the open-grown forest. They have a somewhat dark surface layer. The similar soils have a light colored surface layer. They are fine-loamy, mixed Typic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Argic Cryoborolls are in areas of the mountain grassland. They make up about 30 percent of the unit.

The components of this unit were not mapped separately because it was not necessary to do so to meet the survey objectives.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts. They are underlain by sandstone. They do not have an accumulation of clay in the subsoil. They have a 35 to 60 percent content of rock fragments in the subsoil. Their productivity for timber and forage is lower than that of the dominant soils. The rock outcrop is on ridgetops.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production ranges from 16 to 26 cubic feet per acre. Timber productivity in the map unit is limited by the mountain grassland. The slope affects the operation of tractors. Regeneration of the forest is limited by plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. Natural regeneration may occur only in years when seed production is good and the amount of precipitation is above average. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the

amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of moisture stress. Avalanches can increase the cost of maintaining the roads. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities in the mountain grassland is about 1,250 pounds per acre of air-dry herbage in a normal year. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. Forage productivity of the forest understory is high. Forage production increases after timber harvest. The slope and insufficient water for livestock are limitations affecting range. Livestock tend to gather in the less sloping areas. Building drift fences, herding, and locating salting facilities away from the water help to overcome these limitations.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall and for elk in fall. It also can provide good habitat for blue grouse in summer. It provides good security cover for mule deer, elk, and moose.

87-2B—Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, structurally controlled slopes

This map unit is on structurally controlled slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of lower subalpine forest and dense Douglas-fir forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on north aspects. They have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by sandstone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. Avalanches frequently occur in this map unit. About 20 to 40 percent of the unit is subject to landslides. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs occasionally. The runoff transports eroded soil to the streams.

Vegetation

Dense lodgepole pine forest is at the higher elevations, and Douglas-fir forest is at the lower elevations. The forest understory is a thick mat of shrubs dominated by blue huckleberry and grouse whortleberry at the higher elevations and by snowberry and ninebark at the lower elevations. Scattered areas of mountain grassland also are in this unit.

Habitat Types

Douglas-fir/snowberry and Douglas-fir/ninebark are the major habitat types at the lower elevations. These habitat types are in about 45 percent of the unit. Subalpine fir/blue huckleberry and subalpine fir/grouse whortleberry are the major habitat types at the higher elevations. Subalpine fir/pinegrass and subalpine fir/virginsbower also are at the higher elevations. These habitat types are in about 25 percent of the unit. A cool, moist climate and moderate timber productivity are associated with these habitat types.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir and limber pine habitat types are on south-facing slopes. They have a grassy understory. Their productivity for timber is lower than that of the major habitat types. Idaho fescue/bluebunch wheatgrass is in the mountain grassland.

Geology

This map unit is underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of rock fragments in the subsoil ranges from 15 to 50 percent. Soil properties vary depending on the underlying bedrock. Soils underlain by shale have an accumulation of clay in the subsoil, whereas soils underlain by sandstone do not have an accumulation of clay in the subsoil.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs are underlain by shale. They have a light colored surface layer and a 15 to 35 percent content of rock fragments in the subsoil. The similar soils have a somewhat dark surface layer. They are fine-loamy, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 50 percent of the unit.

The Typic Cryochrepts are underlain by sandstone. They have a 35 to 50 percent content of rock fragments in the subsoil. They make up about 25 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 15 percent of the unit.

The components of this unit are so intricately mixed

that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Argic Cryoborolls. They are in areas of the open-grown forest and the mountain grassland. They have a dark surface layer. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown loam about 11 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown gravelly sandy clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 48 to 64 cubic feet per acre at the lower elevations and from 53 to 71 cubic feet per acre at the higher elevations. Productivity in this unit is limited by the Rock outcrop. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of moisture stress. Avalanches can increase the cost of maintaining the roads. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The forest understory provides a limited amount of forage. The forested areas are poorly suited to transitory range.

Wildlife and fisheries

This unit can provide good habitat for elk in fall and summer and for moose in fall. It also can provide good habitat for moose in winter in areas where subalpine fir seedlings are in the forest understory. It provides good security cover for mule deer, elk, and moose.

87-2C—Argic Cryoborolls complex, structurally controlled slopes, steep

This map unit is on structurally controlled slopes. Elevation ranges from 6,500 to 7,500 feet. The vegetation consists of mountain grassland, mountain shrubland, and dense Douglas-fir forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on south aspects. They have gradients of 45 to 70 percent. The structurally controlled slopes have ridges that are underlain by sandstone or limestone and swales or benches that are underlain by shale, siltstone, or mudstone. Slope and relief are strongly affected by the dip of the underlying bedrock. The soils on dip slopes have a risk of landslides. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs occasionally.

Vegetation

The mountain grassland contains Idaho fescue, bluebunch wheatgrass, junegrass, western needlegrass, and forbs. The mountain shrubland has a canopy of big sagebrush and an understory of Idaho fescue and forbs. Sticky geranium, bearded wheatgrass, mountain brome, and timber oatgrass are common in moist areas. The dense Douglas-fir forest has an understory dominated by snowberry.

Habitat Types

Idaho fescue/bluebunch wheatgrass and big sagebrush/Idaho fescue are the major habitat types in the mountain grassland and the mountain shrubland. Idaho fescue/bearded wheatgrass is in depressions. A warm, dry climate and moderate forage productivity are associated with these habitat types. These habitat types are in about 60 percent of the unit. Douglas-fir/snowberry is the major habitat type in the forested areas. A warm, moist climate and low timber productivity are associated with this habitat type. This habitat type is in about 25 percent of the unit.

Subalpine fir habitat types, which are dissimilar habitat types, are in about 5 percent of the unit. They are in scattered areas of forest at the higher elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, siltstone, or limestone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. Soil properties vary depending on the topography. Soils on the lower slopes have a 10 to 35 percent content of rock fragments in the subsoil, whereas soils on ridgetops and in some forested areas have a 35 to 50 percent content of rock fragments in the subsoil.

Map Unit Composition

The dominant soils are fine-loamy, mixed Argic Cryoborolls and loamy-skeletal, mixed Argic Cryoborolls.

The fine-loamy, mixed Argic Cryoborolls are on the lower slopes. They have a dark surface layer. The similar soils have a very thick, dark surface layer. They are fine-loamy, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 40 percent of the unit.

The loamy-skeletal, mixed Argic Cryoborolls are on rounded ridgetops and in some forested areas. They make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts. They are on ridgetops near sandstone outcrops. They have a light colored surface layer. Their productivity for forage is lower than that of the dominant soils. The rock outcrop is on ridgetops.

Representative Profile of the Soils

The fine-loamy, mixed Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

The loamy-skeletal, mixed Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 30 inches of pale brown clay loam and very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production ranges from 36 to 48 cubic feet per acre in the forested areas. Timber productivity in the map unit is limited by the mountain grassland and the mountain shrubland. The slope affects the operation of tractors. Regeneration of the forest is limited by moisture stress and plant competition. The understory vegetation competes vigorously with tree seedlings for the limited available water. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of moisture stress. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The average production for the potential native plant communities in the mountain grassland and the mountain shrubland is about 1,634 to 1,820 pounds per acre of air-dry herbage in a normal year. The invasion of timothy in some areas can alter the grazing season and affect utilization of the forage. The slope and insufficient water for livestock are limitations affecting range. Livestock tend to concentrate in the less sloping areas. Building drift fences, herding, and locating salting facilities away from the water help to overcome these limitations. The forest understory produces a limited amount of forage. Timber harvest can increase forage production.

Wildlife and fisheries

This map unit can provide good habitat for mule deer in summer and fall. It provides fair habitat for blue grouse in summer.

87-2D—Mollic Cryoboralfs-Typic Cryoboralfs complex, steep

This map unit is on structurally controlled slopes. Elevation ranges from 6,500 to 8,000 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes are on north aspects. They have gradients of 45 to 70 percent. The structurally controlled slopes have ridges underlain by sandstone and swales or benches underlain by shale, siltstone, or mudstone. Slope and relief are strongly controlled by the dip of the underlying bedrock. Avalanches frequently occur in this map unit. Seeps and springs are in drainageways. About 40 to 60 percent of the unit is

subject to landslides. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs occasionally. The runoff transports eroded soil to the streams.

Vegetation

The vegetation is dense subalpine fir forest. Engelmann spruce is in areas along moist drainageways, and whitebark pine is at the higher elevations. The forest understory is composed of a variety of forbs and shrubs, including heartleaf arnica, blue huckleberry, grouse whortleberry, and twinflower. Engelmann spruce commonly has ninebark in the understory.

Habitat Types

Subalpine fir/heartleaf arnica and subalpine fir/blue huckleberry are the major habitat types. Subalpine fir and Engelmann spruce habitat types also are in this unit. They have a shrubby or grassy understory. A cool, moist climate and moderate timber productivity are associated with these habitat types. These habitat types are in about 80 percent of the unit.

Douglas-fir habitat types, which are dissimilar habitat types, are in about 10 percent of the unit. They are at the lower elevations where regeneration of the forest is limited.

Geology

These soils are underlain by thick beds of light colored sandstone, shale, mudstone, or siltstone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties are not obviously associated with landscape features in this unit.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Typic Cryoboralfs.

The Mollic Cryoboralfs have a somewhat dark surface layer. They make up about 50 percent of the unit.

The Typic Cryoboralfs have a light colored surface layer. They make up about 25 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts. They are in areas near sandstone outcrops. They do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 10 inches thick. The lower 31 inches is pale brown very stony loam to clay loam. The substratum to a depth of 60 inches or more is very pale brown very stony loam.

Management

Timber

The potential annual production ranges from 52 to 80 cubic feet per acre. The slope limits the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. Roads should not be built in wet areas. The slope increases the amount of material excavated during road construction. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are slick when wet.

Range

This map unit is poorly suited to range. The forest understory produces a limited amount of forage. The slope limits access to forage.

Wildlife and fisheries

This map unit can provide good habitat for elk and grizzly bear in summer and for moose in summer and fall. It provides good security cover for mule deer, elk, and moose.

87-2E—Mollic Cryoboralfs-Argic Cryoborolls-Rock outcrop complex, structurally controlled slopes, cold

This map unit is on structurally controlled slopes. Elevation ranges from 8,000 to 8,800 feet. The vegetation consists of upper subalpine forest and alpine

meadows. The soils formed in material weathered from interbedded sandstone and shale.

Landform

The dominant slopes have gradients of 45 to 70 percent. The structurally controlled slopes have ridges underlain by sandstone or limestone and swales or benches underlain by shale, siltstone, or mudstone. Slope and relief are strongly controlled by the dip of the underlying bedrock. Avalanches frequently occur in this map unit. About 40 to 60 percent of the unit is subject to further landslides. The soils on the landforms have moderate water-holding capacity, and surface runoff occurs occasionally.

Vegetation

The vegetation is stunted lodgepole pine, whitebark pine, subalpine fir, and Engelmann spruce forest mixed with scattered areas of alpine meadows. The forest understory is a dense mat of shrubs, forbs, and sedges dominated by grouse whortleberry, heartleaf arnica, and elk sedge. The meadows contain short grasses, forbs, and sedges. The most common grasses are tufted hairgrass, bearded wheatgrass, mountain brome, timber oatgrass, and alpine bluegrass. Several fescues are also included.

Habitat Types

Subalpine fir/whitebark pine/grouse whortleberry is the major habitat type. Whitebark pine/subalpine fir also is in this unit. A cold, moist climate and very low timber productivity are associated with these habitat types. These habitat types are in about 40 percent of the unit. Idaho fescue/tufted hairgrass is the major habitat type in the alpine meadows. A cold, moist climate and high forage productivity are associated with this habitat type. These habitat types are in about 20 percent of the unit.

Dissimilar habitat types are in about 20 percent of the unit. Subalpine fir/heartleaf arnica and subalpine fir/virginsbower are at the lower elevations. Their productivity for timber is higher than that of the major habitat types.

Geology

This map unit is underlain by thick beds of light colored sandstone, shale, mudstone, siltstone, or limestone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 10 to 35 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a somewhat dark surface layer, whereas soils that formed under alpine meadows have a dark surface layer.

Map Unit Composition

The dominant soils are fine-loamy, mixed Mollic Cryoboralfs and fine-loamy, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in the forested areas. They have a somewhat dark surface layer and a moderately fine textured subsoil. The similar soils have a light colored surface layer or a fine textured subsoil. They are fine-loamy, mixed Typic Cryoboralfs and fine, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 40 percent of the unit.

The Argic Cryoborolls are in the alpine meadows. They have a dark surface layer. The similar soils have a thick, dark surface layer. They are fine-loamy, mixed Argic Pachic Cryoborolls. These dominant and similar soils make up about 30 percent of the unit.

The Rock outcrop is in areas throughout this map unit. It makes up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed Typic Cryochrepts. They are underlain by sandstone. They do not have an accumulation of clay in the subsoil, have a 35 to 60 percent content of rock fragments in the subsoil, and are moderately coarse textured. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of light brownish gray loam about 12 inches thick. The upper part of the subsoil is light brownish gray clay loam about 14 inches thick. The lower part is light yellowish brown gravelly clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam.

The Argic Cryoborolls have a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is pale brown and light yellowish brown clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown gravelly clay loam.

Management

Timber

The potential annual production is less than 20 cubic feet per acre in the forested areas. Timber productivity in the map unit is limited by the Rock outcrop and the alpine meadows. The slope affects the operation of tractors. Regeneration of the forest is limited by the harsh climate. Trees commonly are poorly formed and can have spiral grain. The forest vegetation helps to

stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is high because of the roads. The stability of the slope should be evaluated before the roads are built. The slope increases the amount of material excavated during road construction. The material exposed on steep cutbanks during road construction tends to erode and is difficult to revegetate because of the harsh climate and moisture stress. Avalanches can increase the cost of maintaining the roads. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Range

The alpine meadows are in about 20 percent of the unit but produce more than 80 percent of the available forage. Because the forage is in widely scattered areas, however, access to it is limited. The average production for the potential native plant communities in the alpine meadows is about 2,225 pounds per acre of air-dry herbage in a normal year. The slope and the Rock outcrop severely limit access by livestock. The snow cover limits the length of the grazing season. Grazing should be delayed until the soils have sufficiently dried out and are firm enough to withstand trampling by livestock. Loose herding of sheep is particularly important for proper utilization of the forage in the alpine meadows. The invasion of timothy into some of the meadows can alter the grazing season and affect utilization of the forage.

Wildlife and fisheries

This map unit can provide good habitat for elk, bighorn sheep, moose, and grizzly bear in summer and fall. It also provides good habitat for blue grouse in fall and winter. It provides good security cover for mule deer, elk, and moose.

88-1A—Typic Cryochrepts, rhyolite flows

This map unit is on lava flows. Elevation ranges from 7,200 to 7,800 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from rhyolite, welded tuff, and obsidian.

Landform

The dominant slopes are on north aspects. They have gradients of 5 to 20 percent. The lava flows are shaped like plateaus. They have a pattern of parallel ridges that are separated by shallow troughs. The landforms are not subject to landslides. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory dominantly is a dense mat of grouse whortleberry. It includes pinegrass on south-facing slopes.

Habitat Types

Subalpine fir/grouse whortleberry is the major habitat type. Lodgepole pine/grouse whortleberry community types also are in this unit. A cool, dry climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Subalpine fir/whitebark pine/grouse whortleberry is at the higher elevations. Its productivity for timber is lower than that of the major habitat types. Subalpine fir/pinegrass is on south-facing slopes where regeneration of the forest is limited by competition from the understory.

Geology

These soils are underlain by volcanic rocks, such as rhyolite, welded tuff, and obsidian. A thin layer of silty loess mantles the surface.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryochrepts. They have a light colored surface layer and a moderately coarse textured subsoil. They do not have an accumulation of clay in the subsoil. The similar soils have an accumulation of clay in the subsoil. They are loamy-skeletal, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Typic Cryoboralfs. The dominant and similar soils make up about 75 percent of the unit.

Dissimilar soils and rock outcrop make up about 25 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Dystric Cryochrepts and sandy-skeletal, mixed Lithic Cryochrepts. Their productivity for timber is lower than that of the dominant soils. The Dystric Cryochrepts are at the higher elevations near Hebgen Lake. They are underlain by granitic rocks and are moderately acid. The Lithic Cryochrepts are in areas near the rock outcrop. They are coarse textured and are 4 to 20 inches deep over bedrock. The rock outcrop is in areas near ridgetops.

Representative Profile of the Soils

The dominant soils have a surface layer of brown

gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 33 to 53 cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited on south-facing slopes by plant competition from pinegrass. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

Unsurfaced roads are slick when wet.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. Insufficient water for wildlife is a limitation. Elk, mule deer, and grizzly bear make incidental use of the unit. The unit provides good security cover for mule deer, elk, and moose.

88-2A—Typic Cryoboralfs-Typic Cryochrepts complex, rhyolite flows

This map unit is on lava flows. Elevation ranges from 6,800 to 7,500 feet. The vegetation consists of lower subalpine forest. The soils formed in material weathered from rhyolite, welded tuff, and obsidian.

Landform

The dominant slopes have gradients of 5 to 20 percent. The lava flows are shaped like plateaus. They have a pattern of parallel ridges that are separated by shallow troughs. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

The vegetation is dense lodgepole pine forest. The forest understory is a thick mat of grouse whortleberry. It includes some pinegrass.

Habitat Types

Subalpine fir/grouse whortleberry is the major habitat type. A cool, dry climate and low or moderate timber productivity are associated with this habitat type. This habitat type is in about 90 percent of the unit.

Subalpine fir/pinegrass, which is a dissimilar habitat type, is in about 10 percent of the unit. It is on south-facing slopes where regeneration of the forest is limited by competition from the understory.

Geology

These soils are underlain by volcanic rocks, such as rhyolite, welded tuff, and obsidian. A thin layer of silty loess mantles the surface.

Characteristics of the Soils

The soils in this map unit are slightly acid and have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties are not obviously associated with landscape features in this unit.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Cryoboralfs and loamy-skeletal, mixed Typic Cryochrepts.

The Typic Cryoboralfs have a light colored surface layer and a medium textured or moderately fine textured subsoil. They have an accumulation of clay in the subsoil. The similar soils have a somewhat dark surface layer. They are loamy-skeletal, mixed Mollic Cryoboralfs. These dominant and similar soils make up about 65 percent of the unit.

The Typic Cryochrepts have a moderately coarse textured subsoil and do not have an accumulation of clay in the subsoil. They make up about 35 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Typic Cryoboralfs have a surface layer of very pale brown gravelly loam about 7 inches thick. The upper part of the subsoil is pale brown cobbly loam about 29 inches thick. The lower 12 inches is pale brown very stony loam to clay loam. The substratum to a depth of 60 inches or more is very pale brown extremely stony loam.

The Typic Cryochrepts have a surface layer of brown gravelly loam about 3 inches thick. The subsoil is very pale brown very cobbly sandy loam about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very cobbly sandy loam.

Management

Timber

The potential annual production ranges from 33 to 53

cubic feet per acre. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by competition from pinegrass. The understory vegetation competes vigorously with tree seedlings for the limited available water.

Roads

Unsurfaced roads are slick when wet.

Range

The forest understory produces a limited amount of forage. The forested areas are poorly suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose. It does, however, provide good security cover for mule deer, elk, and moose.

91-2B—Mollic Cryoboralfs-Argic Cryoborolls complex, colluvial substratum

This map unit is on colluvial fans. Elevation ranges from 7,800 to 8,500 feet. The vegetation consists of lower subalpine forest and mountain meadows. The soils formed in colluvial deposits.

Landform

The dominant slopes have gradients of 10 to 45 percent. The colluvial fans are cone-shaped, colluvial deposits at the base of steep slopes. Avalanches occasionally occur in this unit. The landforms have a moderate risk of landslides. The soils on the landforms have high water-holding capacity. The snowpack is deep, and surface runoff occurs when the snow melts.

Vegetation

Dense lodgepole pine forest is at the lower elevations, and a mixed forest of lodgepole pine and whitebark pine is at the higher elevations. Large scattered areas of mountain meadows are throughout the forest in most delineations. The forest understory is a dense mat of low-growing shrubs, principally grouse whortleberry and blue huckleberry. The vegetation in the mountain meadows includes Idaho fescue, bearded wheatgrass, mountain brome, timber oatgrass, sticky geranium, and abundant forbs.

Habitat Types

Subalpine fir/blue huckleberry is the major habitat type in the forested areas. Subalpine fir/grouse whortleberry and subalpine fir/heartleaf arnica also are in this unit. A cool, moist climate and low timber productivity are associated with these habitat types in this unit. These habitat types are in about 55 percent of the unit. Idaho fescue/bearded wheatgrass is in moist areas of the mountain meadows. High forage productivity is associated with this habitat type. This habitat type is in about 20 percent of the unit.

Subalpine fir/whitebark pine/grouse whortleberry, which is a dissimilar habitat type, is in about 20 percent of the unit. It is at the higher elevations. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by colluvial deposits weathered from sandstone, shale, or limestone.

Characteristics of the Soils

The soils in this map unit have a medium textured surface layer and an accumulation of clay in the subsoil. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Soil properties vary depending on the vegetation. Soils that formed under forest have a somewhat dark surface layer, whereas soils that formed under meadows have a thick, dark surface layer.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Mollic Cryoboralfs and loamy-skeletal, mixed Argic Cryoborolls.

The Mollic Cryoboralfs are in the forested areas. They have a somewhat dark surface layer. The similar soils have a lighter colored surface layer. They are loamy-skeletal, mixed Typic Cryoboralfs. These dominant and similar soils make up about 65 percent of the unit.

The Argic Cryoborolls are in the meadows. They have a thick, dark surface layer. They make up about 20 percent of the unit.

The components of this unit are so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils and rock outcrop make up about 15 percent of the unit. The dissimilar soils are loamy-skeletal, mixed Typic Cryochrepts. They are on the steep, upper slopes and in areas below the areas of rock outcrop. They are moderately coarse textured and do not have an accumulation of clay in the subsoil. Their productivity for timber is lower than that of the dominant soils. The rock outcrop is in areas throughout the unit.

Representative Profile of the Soils

The Mollic Cryoboralfs have a surface layer of dark grayish brown very gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish brown very cobbly clay loam about 5 inches thick. The lower part is

pale brown very cobbly clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very stony loam.

The Argic Cryoborolls have a surface layer of brown loam about 10 inches thick. The subsoil is about 15 inches of pale brown clay loam and very gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Management

Timber

The potential annual production ranges from 32 to 69 cubic feet per acre in the forested areas. Timber productivity in the map unit is limited by the mountain meadows. The terrain is well suited to the operation of tractors. The forest vegetation helps to stabilize the slope. Timber harvest can increase the risk of landslides.

Roads

The risk of landslides occurring is moderate because of the roads. The stability of the slope should be evaluated before the roads are built. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are slick when wet.

Range

The mountain meadows are in about 20 percent of the unit but produce 80 percent of the forage. Because the forage is in widely scattered areas, however, access to it is limited. The average production for the potential native plant communities in the mountain meadows is about 2,225 pounds of air-dry herbage in a normal year. The snow cover is a moderate limitation affecting the length of the grazing season. The invasion of timothy into some of the grassland can alter the grazing season and affect utilization of the forage. The forest understory produces a limited amount of forage. The forested areas are moderately suited to transitory range following timber harvest.

Wildlife and fisheries

This map unit does not provide good habitat for mule deer, elk, or moose.

93-1A—Rubble land

This map unit is on talus slopes. Elevation ranges from 7,000 to 9,800 feet. The unit contains barren rubble land and small areas of soils.

Landform

The dominant slopes have gradients of 20 to 45 percent. The talus slopes are boulder fields. Some areas have rock glaciers and avalanche chutes. Avalanches frequently occur in this map unit. The soils on the landforms have high water-holding capacity, and the potential for surface runoff is low.

Vegetation

Isolated areas of stunted whitebark pine forest or alpine meadows are in this map unit.

Geology

This map unit is underlain by talus deposits derived dominantly from granitic rocks or from sandstone or limestone. Typically, these deposits are angular stones, boulders, and cobbles.

Characteristics of the Soils

This map unit is mostly rubble land. Soils are in less than 10 percent of the unit.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Hard rock occasionally limits excavation. The material exposed on steep cutbanks during road construction tends to ravel. Avalanches can increase the cost of maintaining the roads. Unsurfaced roads are rough and difficult to blade because of large stones.

Range

This map unit is unsuited to range management.

Wildlife and fisheries

This map unit can provide good habitat for mountain goats and bighorn sheep.

Use and Management of the Soils

Following is a description of the use and management of the soils in the survey area. The properties that influence the productivity and suitability of the land for a variety of resource uses are described. The criteria utilized in developing interpretations for the detailed soil map units in the survey area also are described.

Timber

S. Gilbert, timber management staff officer, and R. Gay, zone timber planner, Gallatin National Forest, helped prepare this section.

About 75 percent of the survey area is forested. The principal commercial species are lodgepole pine, Douglas-fir, subalpine fir, and Engelmann spruce. During the last 20 years, the amount of timber harvested in the survey area and sold ranged from 9 million board feet to 67 million board feet per year. It averaged 38 million board feet per year.

Timber Productivity and Management

Table 4 can be used by forest managers in planning the use of soils for production of wood products. Only the map units that have a forested component are listed in the table.

Forest vegetative group gives the habitat type group. These groups reflect the climatic zones in the mountains that result from variations in elevation, slope, and aspect. They are described under the heading "General Nature of the Survey Area."

Potential annual production is the maximum mean annual increment attainable in a fully stocked, natural stand. It is expressed in cubic feet per acre per year. The yields are based on habitat types *(17)* and are adjusted to account for the soils and the condition of the site.

Nonforested area gives the percentage of each map unit that generally is rock outcrop or is vegetated with mountain meadows, mountain grassland, mountain shrubland, or alpine meadows. The productivity of timber is reduced in proportion to the nonforest components.

Regeneration gives limitations to forest regeneration in burned or cutover areas. The limitations in the survey area are harsh climate, moisture stress, and competition.

Harsh climate is mainly a limitation in areas of soils that are at elevations of 7,800 to 9,500 feet. Strong winds in open areas and a short growing season limit regeneration.

Moisture stress is a limitation in areas of soils on south-facing slopes that have a high rate of evapotranspiration; soils that are extremely cobbly in the lower part of the profile and that have low water-holding capacity; and rapidly permeable soils that are underlain by limestone bedrock.

Competition is a limitation if the forest understory contains grasses. Pinegrass, Idaho fescue, and bluebunch wheatgrass are common understory grasses that compete vigorously with tree seedlings. The forested areas either have grasses in the understory or are invaded in cutover or burned areas by grasses from the surrounding grassland or shrubland.

Tractor operation gives limitations to the operation of tractors on the soils. The limitations are slope, wetness, rock outcrop, and soil damage.

The slope is a limitation in map units that have slopes of 45 to 70 percent.

Wetness is a limitation in map units that include poorly drained or somewhat poorly drained soils. The operation of tractors in areas of these soils results in the formation of ruts and lower productivity.

Rock outcrop is a limitation if the percentage of rock outcrop in the map unit is between 25 and 70 percent.

Soil damage is a management concern in areas of soils that have a thin loamy surface layer over a very gravelly or cobbly coarse textured subsoil. The operation of tractors in areas of these soils can result in compaction or in the rearrangement of the surface layer and can severely affect the productivity of the soils.

The productivity of most of the soils in the forested part of the survey area is reduced to some extent if the surface layer is compacted, mixed, or displaced when tractors are operated *(7)*. The damage is greatest if the tractors are operated when the soils are moist or wet; therefore, the operation of tractors should be carefully

planned to minimize soil damage.

Sediment hazard gives the rating assigned to each map unit for the risk of sediments entering drainage channels as a result of erosion or landslides caused by logging. Considerations include erodibility of the exposed surface layer on skid trails, landings, and fire lines; the risk of landslides occurring; and the sediment delivery efficiency. In table 4, map units rated *slight* have a low risk of landslides and either a slight hazard of erosion in the surface layer or a very low or low sediment delivery efficiency. Map units rated *moderate* have a moderate risk of landslides or a moderate hazard of erosion in the surface layer and a moderate or high sediment delivery efficiency. Map units rated *severe* have a high risk of landslides. The susceptibility of the soils to erosion, the sediment delivery efficiency, and the risk of landslides are given in table 8.

Roads

R.F. Creed, forest engineer, and T. Grabinski, supervisory civil engineer, Gallatin National Forest, helped prepare this section.

Road construction is the primary engineering use of soils in forest management. About 3 or 4 miles of road is required to manage 1 square mile of timber. Several kinds of roads are constructed to be used in forest management. Arterial and collector roads generally are either 12 feet wide and have a ditch, or they are 14 feet wide and do not have a ditch. Local logging roads generally are drained by rolling grades and water bars and occasionally by outsloping. They often are closed when logs are not being hauled. They generally are not surfaced.

Data in this section can be used when choosing among alternative road locations and designs. Land use planners can use it to evaluate the feasibility of allocating land to uses requiring roads. Transportation planners can use it to evaluate alternative routes. Design engineers can use it to plan detailed onsite investigations of soil and geology. This information does not eliminate the need for onsite investigation, testing, and analysis.

Engineering Properties and Classification

Table 5 gives estimates of the engineering properties and classification for material in road cutbanks and roadfill. For most of the map units in the survey area, the material rated is from the substratum or the lower part of the subsoil. The upper part of the subsoil is rated when the dominant slopes in the map unit are less than 15 percent. Road construction in these areas requires only minor excavation. The estimates can be used in planning detailed onsite investigations. Estimates are based on field examination and laboratory tests of samples from the survey area.

USDA texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

The *Unified classification* of the soils is determined according to the Unified soil classification system *(1)*. The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC and silty and clayey soils as ML, CL, OL, MH, CH, and OH. Soils exhibiting engineering properties of two groups can have a dual classification, for example: SW-SM.

Fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on ovendry weight. The sieves, numbers 4, 10, and 200 (USA Standard Series), have openings of 4.76, 2.0, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area and on field examination.

Features Affecting Road Construction Costs

Table 6 shows some of the limitations affecting the cost of locating and constructing roads. This information can be used to compare the cost of roads in alternative locations.

Wet areas should be avoided when roads are built because of the hazard of instability and the wetness. A *low* rating indicates that the wet areas are infrequent and easily avoided. A *moderate* rating indicates that the wet areas are common but generally can be avoided by varying the grade and alignment of the road. A *high* rating indicates that the wet areas are difficult to avoid. Information about the kind of wet areas and their frequency of occurrence is in the paragraph describing

the landform in the individual detailed soil map unit descriptions.

Hard bedrock gives information about the difficulty of excavating bedrock. The percentage is estimated based on observation of roadcuts in the survey area and the association of hard bedrock with geologic groups and landforms. *Less than 10 percent* is associated with glacial drift, alluvium, landslides, and sandstone. Glacial drift, alluvium, and landslides are underlain by hard bedrock in places, but these deposits are very deep and the bedrock is rarely encountered during excavation. The sandstone is relatively soft and can be easily excavated. Interbedded sandstone and shale, volcanic rocks, and rhyolite flows are associated with *10 to 50 percent. More than 50 percent* is associated with granitic rocks and limestone.

Drainage channels per mile is the average number of surface drainage channels that must be crossed if roads are built in the map unit. It can be used to estimate the number of culverts needed. The average spacing of the drainage channels is described in the "Landforms" section under the heading "General Nature of the Survey Area."

Slope complexity is a rating of the frequency of changes in the aspect of slopes. As the complexity of the slopes increases, more excavation and filling are needed to maintain the grade and alignment. *Low* indicates that slopes are long and smooth and that the distance between changes in the aspect of the slopes is more than several thousand feet. *Moderate* indicates that the distance between changes in the aspect of the slopes ranges from 800 to several thousand feet. *High* indicates that the distance between changes in the aspect of the slopes is less than 800 feet. The complexity of the slopes is described in the "Landforms" section under the heading "General Nature of the Survey Area."

Sediment hazard on roads gives the rating assigned to each map unit for the risk of sediments entering drainage channels as a result of erosion or landslides caused by road construction. The risk of landslides, the sediment delivery efficiency, and the hazard of erosion for the soil in the lower part of the profile are considered. Map units rated *slight* have a low risk of landslides and either a low or very low sediment delivery efficiency or a slight hazard of erosion in the lower part of the profile. Map units rated *moderate* have a moderate risk of landslides or a moderate or high sediment delivery efficiency and a moderate hazard of erosion in the lower part of the profile. Map units rated *severe* have a high risk of landslides. The hazard of erosion for the soil in the lower part of the profile, the sediment delivery efficiency, and the risk of landslides are given on table 8.

Road Construction and Maintenance

Table 7 shows the limitations affecting road construction and maintenance in each of the detailed soil map units.

Excavation for roads in the survey area is limited by slope, hard rock, and wetness.

The slope is a limitation because it increases the amount of material that is excavated during construction. If a map unit has dominant slopes of 45 to 70 percent, slope is a limitation.

The hard rock is a limitation in map units underlain by limestone or granitic rock if the rock is encountered during excavation. The hard rock increases the difficulty of excavation. If the slope is 10 to 45 percent, the depth of the excavation generally is less than 5 feet. If the soils are less than 60 inches deep over limestone or granitic rock in these areas, hard rock is a limitation. If the slope is 45 to 70 percent, the depth of the excavation ranges from 5 to 25 feet. Hard rock is a limitation in all map units that are underlain by limestone or granitic rock and have a slope of 45 to 70 percent.

The wetness is a limitation because it can limit the period in which the soils can be excavated. Also, the soils in wet areas can have low strength, which requires adding suitable subgrade material.

Maintenance of cut and fill areas gives limitations to maintenance of road cutbanks and roadfill. The limitations are cutbank slough, or slippage of material on cutbanks; cutbank ravel, or loose soil and rock particles rolling down cutbanks; cutbank erosion, or sheet and rill erosion on unvegetated cutbanks; flooding, which can damage roadfill and drainage crossings; and avalanches, which can deposit debris on roads. Cutbank ravel is associated with moderately coarse textured and coarse textured material in the lower part of the profile. Cutbank slough is associated with medium textured, moderately fine textured, and fine textured material in the lower part of the profile and with areas that are wet. It is a limitation in map units that contain seeps, springs, or bogs. Cutbank erosion is associated with a hazard of erosion in the lower part of the profile. The susceptibility of the soil to erosion is shown in table 8. Flooding and avalanches are associated with map units containing flood plains or avalanche paths. Wet areas are associated with map units containing seeps, springs, bogs, or somewhat poorly drained or poorly drained soils.

Fill material used for surfacing roads gives the limitations of the soil material if it is used for road surfaces. The limitations are large stones, which form a rough surface that is difficult to blade; the formation of ruts; and slipperiness of the soil material when it is wet.

The large stones are associated with map units that have hard rock within the depth of excavation. The hard rock breaks into large stones during excavation. The formation of ruts is associated with soils that are medium textured or moderately fine textured in the lower part of the profile and that have a 0 to 35 percent content of rock fragments in the subsoil. Slippery surfaces are associated with soils that are moderately fine textured in the lower part of the profile and that have a 35 to 80 percent content of rock fragments in the subsoil.

Revegetation shows limitations to establishing climatically adapted grasses and legumes in material exposed by road construction and similar practices. Grasses and legumes are commonly seeded on roadcuts and in areas of roadfill to help control erosion and improve the appearance of the roadcuts and roadfill. Revegetation is limited by harsh climate and moisture stress. A harsh climate is associated with elevations of 7,800 to 9,500 feet. A short growing season and desiccation by strong winds limit plant growth. Moisture stress is associated with map units that include rock outcrop and have south-facing slopes of 45 to 70 percent. The content of rock fragments in cut and fill areas limits the water-holding capacity in map units that include rock outcrop. High evapotranspiration rates on steep, south-facing slopes result in moisture stress.

Watershed

R. Miller, civil highway engineer, and S. Glasser, forest hydrologist, Gallatin National Forest, and Dr. C. Montagne, associate professor of soils, Montana State University, helped prepare this section.

The survey area contains a large portion of the headwaters of the Missouri River. The Missouri River drainage basin receives about 2.5 million acre-feet of water from the survey area annually. The quality of this water currently is very high. Most of the runoff occurs during late spring and early summer. Streamflow from the watershed is used to irrigate 439,000 acres of cropland and hayland in five counties. Three major reservoirs are in or near the survey area. Water from a reservoir at Hebgen Lake is used to regulate the flow of water needed for power generation at the Madison Power Plant in Ennis, Montana. The other two reservoirs are part of three municipal watersheds. The survey area also has many waterlines, stock ponds, small reservoirs, and irrigation ditches.

Runoff and erosion can occur in areas where the soils have been disturbed during the application of management practices. Also, landslides can occur more frequently in these areas. Erosion and landslides can be a source of sediment. This sediment can damage the habitat of fish, reduce the storage capacity of reservoirs, and increase the cost of treating domestic water supplies. Soil and water conservation practices help to control erosion, minimize sedimentation, and maintain the quality of water.

Soil Erosion and Slope Stability

Table 8 gives the hazard of erosion for the surface layer and the soil in the lower part of the profile, the rating for the sediment delivery efficiency of the landforms, and the risk of landslides. Watershed scientists commonly use models, which require information from this table, to predict sediment yields. These ratings also can be used to identify areas that require onsite evaluation of hazards and needed soil and water conservation practices during project planning.

Susceptibility of the soil to erosion gives the relative susceptibility of exposed soil to erosion. The ratings are based on observations of erosion in the survey area and on the properties of the soil. The *surface layer* gives the rating if practices that remove the vegetative cover and expose the surface layer to the hazard of erosion are applied. Logging skid trails, fire lines, and severely burned areas are examples. The *lower layer* gives the rating if practices that require excavation and expose the soil in the lower part of the profile to the hazard of erosion are applied. Roadcuts and roadfill are examples.

The shape and content of rock fragments and the texture of the soil are soil properties associated with the hazard of erosion. A rating of *slight* is assigned to soil layers having a medium texture or moderately fine texture and a 35 to 80 percent content of rock fragments and to soil layers having a coarse texture or moderately coarse texture and a 35 to 80 percent content of angular rock fragments. A rating of *moderate* is assigned to soil layers having a medium texture or moderately fine texture and a 0 to 35 percent content of rock fragments and to soil layers having a coarse texture or moderately coarse texture and any percentage of rounded rock fragments.

Sediment delivery efficiency is a rating of the relative probability of eroded soil reaching a stream channel and becoming sediment. It is used in evaluating the hazard of sedimentation. The transport of eroded soil across the landscape is a complex process affected by many properties that must be evaluated onsite. The properties of the landforms that affect sediment delivery were considered when this rating was assigned. The slope and the distance between drainageways were the most important properties used to make these ratings.

Map units rated *very low* have no surface drainage channels. The eroded soil generally is deposited close

to its source and is unlikely to become sediment.

Map units rated *low* have slopes of 0 to 20 percent. The drainage channels in these map units are more than 2,500 feet apart. The eroded soil from areas adjacent to drainage channels can become sediment, but most of the map unit is far enough away from the channels that the transported soil is deposited before it before reaches a channel.

Map units rated *moderate* have slopes of 20 to 45 percent. The drainage channels in these map units are 800 to 2,500 feet apart. Some of the eroded soil from areas close to the drainage channels will become sediment.

Map units rated *high* have slopes of 45 to 70 percent. The drainage channels in these map units are less than 800 feet apart. Almost all of the eroded soil close to the drainage channels will become sediment.

The hazards of erosion and sedimentation and the need for soil and water conservation practices should be evaluated onsite in areas where sediment delivery efficiency is moderate or high. Controlling the sediment is more difficult when delivery efficiency is high.

Risk of landslides is a rating of the relative probability of downslope movement of masses of soil and rock material under natural conditions. The most common kinds of landslides that occur in the survey area are rotational slumps and land flows. They generally are associated with concentrations of ground water over a layer of material that has restricted permeability *(11)*. The ratings can be used to compare the relative probability of landslides occurring on alternative areas. This probability should be a consideration in determining which areas should have an onsite evaluation of slope stability when designing projects. The ratings are based on observations of landslides in the survey area and their association with combinations of map unit properties. The slope, geologic group, and landforms produced by landslides were the major properties considered. The percentage of rock outcrop and the presence of wet soils were considered in a few places.

A map unit is rated *low* if the soils in the unit have a slope of 10 to 45 percent and are not underlain by shale and sandstone or if they have a slope of 45 to 70 percent and are not underlain by shale and sandstone or by volcanic rocks.

A map unit is rated *moderate* if the unit is made up of well drained soils and deposits from landslides; if the soils in the unit are moderately fine textured and formed in glacial drift derived from sandstone and shale; if the soils in the unit have a slope of 10 to 45 percent and are underlain by shale and sandstone; or if the soils in the unit have a slope of 45 to 70 percent and are underlain by volcanic rocks.

A map unit is rated *high* if the unit is made up of somewhat poorly drained soils and deposits from landslides or if the soils in the unit have a slope of 45 to 70 percent and are underlain by sandstone and shale.

Range

N. Howarth, retired forest range conservationist, Gallatin National Forest, and J. Miller, director of range management, Pacific Southwest Region, Forest Service, helped prepare this section.

The survey area provides range for livestock from adjoining farms and ranches in summer. It provides about 69,000 animal unit months of grazing. Most of the livestock is cattle, but a few bands of sheep are at the higher elevations. The grazing season generally begins in mid-June and ends in mid-September, but it varies with the elevation. Most of the rangeland contains mountain grassland, mountain shrubland, and mountain meadows. Open-grown forests that have an understory of bunchgrass also provide important range. Densely forested areas can be used as transitory range following timber harvest or forest fires. Removal of the forest canopy can stimulate forage production in the understory. Production on transitory ranges peaks about 11 years after the canopy is removed and then declines as the forest regenerates and the canopy closes *(2)*.

Herbage Production

Table 9 gives the herbage production by major vegetative group for map units in the survey area.

The *major vegetative group* is a grouping of vegetative types that have broadly similar properties. The groups reflect the climatic zones in the mountains that result from variations in elevation, slope, and aspect. They are described in the "Vegetation" section under the heading "General Nature of the Survey Area."

The herbage productivity of *shrubs, forbs,* and *grass* is given in air-dry pounds per acre per year of growth regardless of palatability to livestock. It includes the growth of leaves, twigs, and fruits of woody plants in the current year. In the mountain grassland and mountain shrubland, a production increase of about 60 percent can be expected during good years. In the mountain meadows the expected increase is about 20 percent. All production is expected to decrease by 20 percent during poor years *(15)*. Productivity of forest sites is for understory productivity in the shade of a forest canopy. Production estimates are based on unpublished data from the soil survey in adjacent Madison County and from Forest Service data *(2)*.

Range Management

Table 10 shows, for each soil that supports rangeland vegetation suitable for grazing, the potential

annual forage production, the range site, and the properties affecting range management. It can be used to evaluate the suitability of a map unit for grazing by domestic livestock.

The *forage production* for grassland and shrubland is the amount of herbage production palatable to domestic livestock. The forage in the shrub component is not considered palatable, but 10 percent of that in the forb component is palatable. The proportion of grass production considered palatable varies with the composition of the species. Palatability estimates were derived from range analysis handbooks of the Forest Service and Natural Resources Conservation Service, U.S. Department of Agriculture, and in consultation with range conservationists from the Forest Service and Montana State University.

The forage production in forested areas is the amount of herbage production in the understory palatable to domestic livestock. The estimated amount for *under canopy* is the amount of vegetation that can be expected under the shade of a forest canopy. The estimated amount for *canopy removed* is the amount of vegetation that can be expected about 11 years after the canopy is removed by timber harvest or fire. The values are based on production in the shade of a canopy and are adjusted using factors developed by the Forest Service *(2)*. These factors take into account changes in composition of the understory vegetation after the canopy is removed. The vegetative groups and water-holding capacity of the soils also are considered.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. If the soils are forested, they are not assigned a range site.

Livestock grazing gives the degree and kind of limitations to livestock grazing. Any of several properties can limit livestock grazing. Forage productivity can be low in forested areas. The slope can be so steep that livestock tend to gather in small, included areas of gentler slopes. Meadows can be in scattered areas surrounded by forest that produces limited forage. At the higher elevations the grazing season is short. If the soils have low strength, trampling by livestock can damage the vegetation. The ratings can be used to compare the potential value of range for livestock in alternative areas and to identify areas that can be used as range. Livestock generally graze in areas that include more than one map unit. The degree of limitation imposed by an unfavorable property often depends on the properties of adjacent map units. These ratings should, therefore, not be used for planning grazing management without onsite investigation.

A *slight* limitation indicates that properties are favorable for livestock grazing. The limitations can easily be overcome by applying common range management practices. Map units rated slight have slopes of 0 to 30 percent, have a potential forage production of more than 400 pounds per acre per year in more than 50 percent of the unit, and are below an elevation of 8,000 feet.

A *moderate* limitation indicates that one or more properties are unfavorable for livestock grazing. Slope is a moderate limitation in map units that have dominant slopes of 30 to 70 percent. Additional moderate limitations include a short growing season in map units that are at elevations of more than 8,000 feet, low productivity in map units that are forested and have potential forage production of 200 to 400 pounds per acre per year after the canopy is removed, scattered areas of forage in map units in which 30 to 50 percent of the acreage is in small meadows and the rest is forested, and wetness in map units that include somewhat poorly drained or poorly drained soils. These limitations can be overcome by special management practices or can make grazing less profitable than in units rated slight.

A *severe* limitation indicates that one or more properties are so unfavorable for livestock grazing that even when the most intensive range management is applied, the map unit is poorly suited to range. Severe limitations are low productivity in map units that are forested and have potential forage production of less than 200 pounds per acre per year and scattered areas of forage in map units in which less than 30 percent of the acreage is in small meadows and the rest is forested. These limitations increase the difficulty of managing rangeland or decrease its profitability.

Wildlife Habitat

T. Puchlerz, wildlife biologist, Gallatin National Forest, and J. Cado, wildlife biologist, Montana Department of Fish, Wildlife, and Parks, helped prepare this section.

Wildlife habitat management in the survey area normally consists of two general kinds of activities. The existing wildlife habitat values are identified and are protected or enhanced by coordinating activities, such as timber harvest, road construction, and recreational uses, with use of habitat by wildlife. The habitat also is directly improved by applying practices to improve the quality of vegetation for wildlife use. An example is prescribed burning.

Soil properties, slope, elevation, aspect, and other properties of the map units in this survey area directly affect the kind and amount of vegetation available to wildlife and the accessibility of the vegetation. This survey can be used to help identify and inventory

potential wildlife habitat. The detailed soil map units can be used as sampling units when inventorying wildlife habitat, thereby holding relatively constant those properties affecting the kind and amount of vegetation and the accessibility of the vegetation to wildlife. The properties of the map units can be used to evaluate potential habitat values of alternative areas and the potential for habitat improvement during the planning process. Wildlife biologists should be consulted when using this survey to evaluate potential habitat values of specific map units. The importance of map unit properties in evaluating potential habitat value varies with different species and with the location of delineation boundaries.

Elk, mule deer, whitetail deer, moose, bighorn sheep, mountain goat, black bear, grizzly bear, and a large variety of birds and small mammals are in the survey area. The large number of species is a result of the diversity of habitats in the area.

In table 11, the map units in the survey area are rated according to their potential for providing habitat for mule deer, elk, and moose. These species are important game animals. They inhabit large areas of rangeland throughout the survey area and have diverse habitat requirements. In places individual map units provide only part of the necessary habitat. The ratings in the table apply only if all of the necessary habitat is available. They can be used in planning to compare habitat values of alternative areas and to identify areas with potential for habitat improvement. They should not be used for project design or for habitat evaluation of specific sites without onsite investigation.

The potential of map units to provide forage and cover for each species is rated. The season of year when forage is normally available also is given. *Forage* is rated good, fair, or poor. A rating of *good* indicates that the map unit has potential to produce a diversity of highly desirable forage species. A rating of *fair* indicates that the potential production is composed of a few highly desirable forage species but is mostly forage of intermediate value. A rating of *poor* indicates that the potential production is mostly forage of low value.

Forage availability is the time of year when the forage is available to wildlife. The availability is determined by the temperatures in winter, depth of the snowpack, slope, elevation, and aspect. Forage availability is separated into three seasons: summer, fall, and winter. Summer includes the period from June 15 to September 15, fall includes the period from September 15 to November 15, and winter includes the period from November 15 to June 15.

The *cover* is rated good, fair, or poor. A rating of *good* indicates that vegetation or topography provides ample security, screening, and escape cover. A rating of *fair* indicates limited vegetation or topography for wildlife security, screening, and escape cover. A rating of *poor* indicates a lack of vegetation or topography necessary for wildlife security, screening, and escape cover.

The ratings are based on the following species habitat requirements.

Mule deer generally summer in Douglas-fir forests. About 80 percent of their diet is composed of browse. They browse on low-growing shrubs, such as snowberry, serviceberry, ninebark, and sagebrush. They generally winter on foothills at the lower elevations. Winter range generally contains sagebrush and bunchgrasses on south-facing slopes and Douglas-fir forest on north-facing slopes *(10)*.

Elk generally summer at midelevations. Their summer range generally consists of moist mountain meadows that are in moist forest habitat types. Their diet in summer is mostly herbaceous plants. Elk winter on foothills at the lower elevations. Winter range generally contains bunchgrass and low-growing shrubs on south-facing slopes and Douglas-fir forest on north-facing slopes *(9)*.

Moose summer in moist mountain meadows and the adjacent, moist forest habitat types. Their diet in summer consists of about one-third herbaceous plants and two-thirds browse from willow and conifer seedlings. Their diet in winter consists almost entirely of browse from willow or conifer saplings and seedlings. Winter range typically contains willow in wet areas or old growth timber stands that have an abundant supply of subalpine fir seedlings and saplings in the understory. Generally, it is below elevations of 7,000 feet where the snow is less than 30 inches deep.

Wildfire

L. Keown, fire management officer, Gallatin National Forest, helped prepare this section.

Plans for wildfire control are incorporated into land management plans and fire management plans. This soil survey can be used to estimate suppression costs and predict the effect of fire on vegetation and soils.

The detailed soil map units identify the habitat types and describe the extent of their distribution within the map units. The habitat types can be used to assign map units to fire habitat type groups as defined by the Forest Service *(6)*. The fire habitat type groups are used to predict the response of vegetation to fire.

Suppression costs are partially dependent on terrain and soil properties, which are described in the map unit descriptions. Slope, rock outcrop, and the content of

rock fragments in the surface layer are some of the properties that affect the cost of constructing a fire line. The susceptibility of the surface layer to erosion is given in table 8. This information can be used to plan erosion-control measures to be applied to soil that has been disturbed by fire suppression activities.

Recreation

Recreational activities in the survey area include hunting, fishing, camping, cross-country skiing, downhill skiing, and hiking. Soil properties, slope, aspect, elevation, vegetation, and other properties of the detailed soil map units affect suitability for recreational use. This survey can be used during the planning process to identify areas suitable for a recreational use and limitations for such use. Specialists in recreational use should be consulted to determine which map unit properties affect a given recreational use. The detailed soil map units can then be used to identify suitable areas and their limitations.

Minerals

This soil survey can be used to help evaluate the effect of mineral exploration activities on soils and vegetation and to determine the conservation practices that should be applied in areas being rehabilitated after exploration. The soils, vegetation, landform, and geology are described in the detailed soil map units. Table 7 gives limitations to excavation and revegetation of roadcuts and roadfill. These limitations also apply to many kinds of mineral exploration activities. Table 8 shows the susceptibility of the soil to erosion, the sediment delivery efficiency, and the risk of landslides. These ratings can be used to determine which erosion- and sediment-control practices should be applied following mineral exploration activities.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(19)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. The series level of classification was not used in this survey. Tables 12 and 13 show the classification of the soils in the survey area. The taxonomic categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Inceptisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ochrept (*Ochr*, meaning pale, plus *ept* from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryochrepts (*Cry* meaning cold, plus *ochrept*, the suborder of the Inceptisols that has a cold temperature regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Cyrochrepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, mixed Typic Cryochrepts.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. In this survey area, soils were mapped at a higher taxonomic level and series were not recognized.

Several assumptions were made in classifying the soils in the survey area because criteria for classification often require laboratory data that were not available or observations that were not made when the soils were classified. This is particularly true of classes dependent on temperature, moisture, or chemical data.

The soils in the survey area are in either the cryic or the frigid temperature regime. The boundary between these two classes is considered to be the lower boundary of the subalpine fir climax forest or an equivalent elevation-aspect combination. Data for much of the Northern Rocky Mountains area indicate that this is a close, though imperfect, approximation.

The soils in the survey area generally are in the udic or ustic moisture regime. Mountain grassland, mountain shrubland, open-grown Douglas-fir forest that has an understory dominated by bunchgrasses, and dense Douglas-fir or lodgepole pine forest that has an understory dominated by snowberry, spirea, or similar shrubs were used as indicators of the ustic moisture regime. All other vegetation was considered to indicate the udic moisture regime. A limited amount of soil moisture data from other survey areas indicates that these are reasonable indicators of soil moisture regimes. Some of the soils in adjacent soil survey areas are in the aridic moisture regime. Some soils from the aridic moisture regime are included in mapping with soils in the ustic regime in this survey area. These soils

are on south-facing slopes at the lower elevations.

The mineralogy of most of the soils in the survey area is mixed. X-ray defraction data obtained for the B horizon of four soil pedons from the survey area indicate that the four soils have mixed mineralogy. Two other mineralogy classes also are identified in the survey area. They are carbonatic and siliceous. Soils that formed in material derived from limestone have carbonatic mineralogy, and soils that formed in obsidian and quartzitic sand have siliceous mineralogy.

A representative pedon for each of the soils mapped in the survey area follows. The descriptions are arranged in alphabetical order by suborder. The representative pedons are preceded by a brief discussion of taxa at higher levels than the representative pedon. The range of characteristics of soils in the taxa follows the representative pedon. Soil colors are for moist soil unless otherwise indicated. The soils mapped in the survey area are listed by suborder in table 12.

A description of roots, pores, or organic horizons is not included in the description of the taxonomic units because they were not described in the field. The general characteristics of roots in the soils in the survey area are shown in table 14. The organic horizon generally is thin, or less than 0.5 inch thick. Most of the soils in the survey area have an organic horizon; however, this horizon is thick only in local areas near streams and in poorly drained areas.

Aquents

Aquents are wet soils that have undergone limited profile development. They formed in low depressions and on flood plains, which receive new deposits of alluvium frequently. Their water table is at or near the surface most of the year.

Cryaquents

Cryaquents are the cold Aquents. The vegetation is mostly a wet meadow of sedges or willow. Cryaquents are at elevations of 6,600 to 8,600 feet. They are in one map unit in this survey area.

No one profile can represent these soils. In one of the more common profiles, however, the soils are coarse-silty over sandy or sandy-skeletal, mixed Typic Cryaquents.

Representative Pedon

A—0 to 4 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, very friable, nonsticky and nonplastic; medium acid.

Cg1—4 to 7 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid.

Cg2—7 to 9 inches; light gray (10YR 7/1) silt loam, very dark gray (10YR 3/1) moist; massive; soft, friable, slightly sticky and slightly plastic; slightly acid.

Cg3—9 to 15 inches; light gray (10YR 7/1) very fine sandy loam, grayish brown (10YR 5/2) moist; few fine distinct yellowish brown (10YR 5/4 moist) mottles; massive; slightly hard, friable, nonsticky and nonplastic; slightly acid.

Cg4—15 to 18 inches; light gray (10YR 7/2) gravelly sandy loam, grayish brown (10YR 5/2) moist; few fine distinct yellowish brown (10YR 5/4 moist) mottles; single grain; soft, very friable, nonsticky and nonplastic; about 20 percent pebbles; slightly acid.

Cg5—18 to 35 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; slightly acid.

Cg6—35 to 60 inches; light gray (10YR 7/2) very cobbly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; about 55 percent cobbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Madison Range, Gallatin River, NE¼ sec. 15, T. 13 S., R. 4 E., detailed soil map unit 66-1A. The profile described formed in alluvium dominated by obsidian sands. It is in a wet depression that is adjacent to ponded water on a glacial outwash terrace. The vegetation is a wet mountain meadow that is dominated by sedges.

Range in Characteristics

The following data are based on the detailed descriptions of four pedons.

A horizon:

Value—3 to 6, dry; 2 to 4, moist
Chroma—1 or 2, moist
Texture of the fine-earth fraction—silty clay loam, silt loam, silt, very fine sandy loam
Content of rock fragments—0 to 20 percent
Reaction—5.6 to 7.3
Thickness—2 to 6 inches; average 4 inches

C or Cg horizon:

Value—6 or 7, dry; 3 to 6, moist
Chroma—1 to 4, moist
Texture of the fine-earth fraction—silty clay loam, sandy clay loam, silt loam, loam, sandy loam, loamy sand
Content of rock fragments—0 to 55 percent
Reaction—6.1 to 7.8

Aquolls

Aquolls are wet soils that have a dark surface layer. They formed in alluvial deposits on flood plains or in depressions. They are not subject to flooding or to the deposition of new sediment. They have a fluctuating water table that is within a depth of 24 inches in spring when the snow melts.

Cryaquolls

Cryaquolls are the cold Aquolls. The vegetation is sedge meadows, willow, or wet forest types with stands dominated by Engelmann spruce. Cryaquolls are on 0 to 5 percent slopes at elevations of 6,600 to 8,600 feet. They are in two map units in this survey area.

No one profile can represent these soils. In one of the more common profiles, however, the soils are fine-loamy, mixed Argic Cryaquolls.

Representative Pedon

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) moist; weak very fine granular structure; hard, friable, nonsticky and nonplastic; slightly acid.

A2—2 to 6 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; slightly acid.

BA—6 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/1) moist; common fine distinct yellowish brown (10YR 5/6 moist) mottles; moderate coarse subangular blocky structure; extremely hard, firm, sticky and slightly plastic; slightly acid.

2Bt—9 to 14 inches; grayish brown (10YR 5/2) sandy clay loam, gray (10YR 5/1) moist; common fine prominent strong brown (7.5YR 5/6) mottles, yellowish brown (10YR 5/6) moist; weak coarse subangular blocky structure; extremely hard, firm, sticky and slightly plastic; slightly acid.

2BC—14 to 28 inches; very pale brown (10YR 7/3) sandy clay loam, brown (10YR 5/3) moist; many fine prominent strong brown (7.5YR 5/6) mottles, yellowish brown (10YR 5/6) moist; weak coarse subangular blocky structure; extremely hard, firm, sticky and slightly plastic; neutral.

2C—28 to 60 inches; light gray (10YR 7/2) gravelly sandy clay loam, pale brown (10YR 6/3) moist; many fine prominent strong brown (7.5YR 5/6) mottles, strong brown (7.5YR 5/8) moist; massive; very hard, firm, sticky and slightly plastic; about 15 percent pebbles; mildly alkaline.

Location and Setting

Southwestern Montana, Park County, Crazy Mountains, Shields River, NW¼ sec. 7, T. 5 N., R. 10 E., detailed soil map unit 66-1A. The profile described formed in alluvium. It is on a small alluvial fan. The vegetation is a wet mountain meadow that is dominated by sedges.

Range in Characteristics

The following data are based on the detailed descriptions of seven pedons.

A horizon:

Value—3 or 4, dry; 2 or 3, moist
Chroma—1 or 2, moist
Texture of the fine-earth fraction—loam, silt loam
Reaction—6.1 to 7.8
Thickness—5 to 20 inches; average 11 inches

Bt horizon:

Hue—7.5YR, 10YR
Value—4 or 5, dry; 3 to 6, moist
Chroma—1 to 6, moist
Texture of the fine-earth fraction—clay, clay loam, silty clay loam, sandy clay loam, loam
Content of rock fragments—0 to 30 percent
Reaction—6.1 to 7.8
Thickness—5 to 22 inches; average 17 inches

Boralfs

Boralfs are cool and cold soils that have an accumulation of clay in the subsoil. They are mainly under forest vegetation, but in places they are in areas of mountain meadows or mountain grassland. The Boralfs that are in areas of mountain meadows or mountain grassland may have been under forest vegetation in the past. Most of the Boralfs are at elevations of 6,500 to 8,500 feet. Generally, they formed in material that contained an appreciable amount of clay. The parent material commonly is derived from shale and volcanic rocks. Boralfs tend to be more fertile than soils that do not have an argillic horizon because of the increased retention of nutrients and water in the subsoil.

Cryoboralfs

Cryoboralfs are the cold Boralfs. They generally are in areas of subalpine fir or subalpine fir and whitebark pine climax forest. They are most common in the drier subalpine fir habitat types, which have a deficit of soil moisture in late summer. They are in the warmest part of the cryic temperature regime.

Aquic Cryoboralfs

Aquic Cryoboralfs are the wet Cryoboralfs. They are the dominant soils in four map units in this survey and

are dissimilar soils in a number of map units. A risk of landslides and low soil strength are associated with these soils.

Aquic Cryoboralfs, Fine-Loamy, Mixed

Representative Pedon

E1—0 to 4 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; extremely acid.

E2—4 to 7 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; medium acid.

Bt1—7 to 13 inches; light brownish gray (10YR 6/2) clay loam, brown (10YR 4/3) moist; strong medium and fine angular blocky structure; slightly hard, firm, slightly sticky and plastic; common distinct clay films on faces of peds; strongly acid.

Bt2—13 to 20 inches; light gray (10YR 7/2) sandy clay loam, brown (2.5Y 5/3) moist; common fine prominent yellowish brown (10YR 5/8 moist) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common distinct clay films on faces of peds; strongly acid.

BC—20 to 25 inches; light yellowish brown (10YR 6/4) gravelly clay loam, olive brown (2.5Y 4/4) moist; common fine prominent yellowish brown (10YR 5/8 moist) mottles; massive; slightly hard, firm, slightly sticky and plastic; about 15 percent pebbles; medium acid.

CB—25 to 32 inches; grayish brown (2.5Y 5/2) gravelly clay loam, dark brown (2.5Y 4/3) moist; common fine prominent yellowish brown (10YR 5/8 moist) mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; about 25 percent pebbles; medium acid.

C—32 to 60 inches; grayish brown (2.5Y 5/2) gravelly clay loam, olive brown (2.5Y 4/3) moist; common fine distinct yellowish brown (10YR 5/8 moist) mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; about 25 percent pebbles; medium acid.

Location and Setting

Southwestern Montana, Gallatin County, Hilgard Mountains, Yellow Mule Ridge, NE¼NW¼ sec. 20, T. 7 S., R. 3 E., detailed soil map unit 82-2C. The profile described formed in material derived from sandstone. It is on a dip slope adjacent to a wet depressional area. The major habitat type is subalpine fir/whitebark pine/ grouse whortleberry.

Range in Characteristics

The following data are based on the detailed descriptions of four pedons.

E horizon:

Value—6 or 7, dry; 3 to 5, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—clay loam, silt loam, loam
Content of rock fragments—0 to 10 percent
Reaction—4.0 to 6.5
Thickness—5 to 8 inches; average 7 inches

Bt horizon:

Hue—7.5YR to 2.5Y
Value—6 or 7, dry; 4 or 5, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, sandy clay loam, loam
Content of rock fragments—0 to 20 percent
Reaction—5.1 to 6.5
Thickness—9 to 25 inches; average 15 inches

BC or C horizon:

Hue—10YR, 2.5Y
Value—5 or 6, dry; 4, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam
Content of rock fragments—5 to 25 percent

Mollic Cryoboralfs

Mollic Cryoboralfs are the Cryoboralfs that have a dark surface layer. They are the dominant soils in 28 map units in this survey. They are near the boundary between forest and grassland or are in forested areas that have an understory dominated by grass. Regeneration of the forest in areas of these soils is limited by moisture stress and plant competition.

Mollic Cryoboralfs, Fine-Loamy, Mixed

Representative Pedon

A—0 to 12 inches; light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; strong medium and coarse subangular blocky structure; slightly hard, friable, nonsticky or slightly sticky and slightly plastic; about 5 percent pebbles; medium acid.

Bt1—12 to 26 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; strong fine and medium angular blocky structure; hard, firm, sticky and plastic; common distinct clay

films on faces of peds; about 5 percent pebbles; slightly acid.

Bt2—26 to 39 inches; light yellowish brown (10YR 6/4) gravelly clay loam, brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to strong medium and coarse angular blocky; hard, firm, sticky and plastic; common distinct clay films lining root channels and on faces of peds; about 15 percent pebbles; slightly acid.

BC—39 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak moderate and coarse prismatic structure parting to moderate coarse and medium angular blocky; hard, firm, sticky and plastic; about 5 percent pebbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Madison Range (Hilgards), in the Taylor Fork drainage area, Cache Creek, SE¼ sec. 29, T. 8 S., R. 3 E., detailed soil map unit 87-2E. The profile described formed in material derived from interbedded sandstone and shale. It is on a dip slope. The vegetation is an alpine meadow, which is adjacent to upper subalpine forest.

Range in Characteristics

The following data are based on the detailed descriptions of 46 pedons.

A horizon:

Hue—5YR to 10YR
Value—4 to 6, dry; 2 or 3, moist
Chroma—1 to 3, moist
Texture of the fine-earth fraction—silty clay loam, clay loam, loam, silt loam
Content of rock fragments—0 to 25 percent
Reaction—4.0 to 6.5
Thickness—2 to 26 inches; average 14 inches

Bt horizon:

Hue—2.5YR to 10YR
Value—4 to 8, dry; 4 to 6, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—silty clay loam, clay loam, sandy clay loam, loam, silt loam, sandy loam
Content of rock fragments—0 to 30 percent
Reaction—5.1 to 7.3
Thickness—4 to 40 inches; average 22 inches

BC or C horizon:

Hue—2.5YR to 10YR
Value—4 to 8, dry; 4 or 5, moist
Chroma—3 to 5, moist
Texture of the fine-earth fraction—silty clay loam, clay loam, sandy clay loam, loam, sandy loam
Content of rock fragments—0 to 60 percent
Reaction—5.1 to 7.3
Thickness—6 to 38 inches; average 22 inches

Mollic Cryoboralfs, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 5 inches; dark grayish brown (10YR 4/2) very gravelly loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; about 40 percent pebbles and cobbles; medium acid.

AB—5 to 15 inches; dark grayish brown (10YR 4/2) very gravelly loam, black (10YR 2/1) moist; weak coarse prismatic structure; soft or slightly hard, friable, slightly sticky and slightly plastic; about 40 percent pebbles and cobbles; medium acid.

Bt1—15 to 20 inches; yellowish brown (10YR 5/4) very cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine or medium subangular blocky structure; hard, firm, sticky and very plastic; common distinct clay films on faces of peds; about 40 percent pebbles, cobbles, and stones; medium acid.

Bt2—20 to 28 inches; pale brown (10YR 6/3) very cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and very plastic; many prominent clay films on faces of peds; about 40 percent pebbles, cobbles, and stones; medium acid.

BC—28 to 40 inches; pale brown (10YR 6/3) very stony loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; about 40 percent cobbles and stones; medium acid.

C—40 to 60 inches; very pale brown (10YR 7/3) very stony loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, slightly sticky and slightly plastic; about 40 percent cobbles and stones; medium acid.

Location and Setting

Southwestern Montana, Park County, Crazy Mountains, in the Shields River area, Shields River Road, NW¼ sec. 21, T. 5 N., R. 11 E., detailed soil map unit 84-2B. The profile described formed in material derived from interbedded sandstone and shale. It is on a structurally controlled slope. The vegetation is mountain grassland.

Range in Characteristics

The following data are based on the detailed descriptions of 26 pedons.

A horizon:
- Hue—7.5YR, 10YR
- Value—4 to 6, dry; 2 to 4, moist
- Chroma—1 to 3, moist
- Texture of the fine-earth fraction—clay loam, loam, silt loam, sandy loam
- Content of rock fragments—0 to 60 percent
- Reaction—4.5 to 7.3
- Thickness—4 to 14 inches; average 9 inches

Bt horizon:
- Hue—5YR to 10YR
- Value—3 to 7, dry; 3 to 5, moist
- Chroma—1 to 6, moist
- Texture of the fine-earth fraction—silty clay loam, sandy clay loam, loam, silt loam, sandy loam
- Content of rock fragments—40 to 80 percent
- Reaction—5.1 to 8.4
- Thickness—5 to 53 inches; average 29 inches

BC horizon:
- Hue—5YR to 10YR
- Value—5 to 7, dry; 3 to 5, moist
- Chroma—3 to 6, moist
- Texture of the fine-earth fraction—clay loam, sandy clay loam, loam, sandy loam, loamy sand
- Content of rock fragments—40 to 80 percent
- Reaction—5.1 to 8.4

Typic Cryoboralfs

Typic Cryoboralfs represent the central concept of Cryoboralfs. They are the dominant soils in 22 map units in this survey. They share common taxonomic boundaries with Argiborolls, Cryoborolls, and Cryochrepts.

Typic Cryoboralfs, Fine-Loamy, Mixed

Representative Pedon

E1—0 to 5 inches; very pale brown (10YR 7/3) loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, very friable, nonsticky and nonplastic; medium acid.

E2—5 to 11 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and nonplastic; medium acid.

Bt1—11 to 16 inches; light yellowish brown (10YR 6/4) clay loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, firm, sticky and slightly plastic; few distinct clay films on faces of peds; slightly acid.

Bt2—16 to 32 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak very coarse subangular blocky structure; hard, firm, slightly sticky and plastic; few distinct clay films on faces of some peds and on most pebbles; about 25 percent pebbles; medium acid.

CB—32 to 60 inches; light yellowish brown (10YR 6/4) gravelly loam, brown (10YR 4/4) moist; massive; very hard, very firm, slightly sticky and slightly plastic; about 35 percent pebbles and cobbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Bridger Range, south of Brackett Creek, in the Miles Creek drainage area, SE¼ sec. 26, R. 1 N., R. 7 E., detailed soil map unit 86-3B. The profile described formed in colluvium derived from mixed sandstone and shale. It is on a structurally controlled scarp slope. The major habitat type is subalpine fir/blue huckleberry.

Range in Characteristics

The following data are based on the detailed descriptions of 26 pedons.

E horizon:
- Hue—7.5YR, 10YR
- Value—5 to 7, dry; 3 to 5, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—silty clay loam, silt loam, loam
- Content of rock fragments—0 to 30 percent
- Reaction—5.1 to 7.3
- Thickness—2 to 30 inches; average 9 inches

Bt horizon:
- Hue—7.5YR to 2.5Y
- Value—4 to 7, dry; 3 to 5, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—clay loam, silt loam, loam, sandy clay loam
- Content of rock fragments—0 to 30 percent
- Reaction—5.6 to 7.8
- Thickness—10 to 47 inches; average 23 inches

C or CB horizon:
- Hue—7.5YR to 2.5Y
- Value—5 to 7, dry; 4 to 7, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—sandy clay loam, clay loam, loam, sandy loam
- Content of rock fragments—15 to 40 percent
- Reaction—6.1 to 7.8

Typic Cryoboralfs, Loamy-Skeletal, Mixed

Representative Pedon

E—0 to 7 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 4/2) moist; moderate medium

platy structure; slightly hard, friable, nonsticky and nonplastic or slightly plastic; about 35 percent pebbles; strongly acid.

Bt1—7 to 17 inches; pale brown (10YR 6/3) cobbly loam, dark grayish brown (10YR 4/2) moist; moderate fine angular blocky structure; hard, firm, sticky and slightly plastic; few distinct clay films on faces of peds; about 35 percent cobbles; strongly acid.

Bt2—17 to 36 inches; pale brown (10YR 6/3) very stony loam, brown (10YR 4/3) moist; weak moderate subangular blocky structure; slightly hard or hard, firm, slightly sticky and slightly plastic; common distinct clay films on faces of peds; about 55 percent stones; strongly acid.

Bt3—36 to 48 inches; pale brown (10YR 6/3) very stony clay loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common distinct clay films on faces of peds; about 55 percent stones; medium acid.

BC—48 to 60 inches; very pale brown (10YR 7/3) very stony loam, pale brown (10YR 6/3) moist; weak medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; about 55 percent stones; medium acid.

Location and Setting

Southwestern Montana, Madison County, Madison Range (Hilgards), north of Quake Lake, in the Beaver Creek drainage area, SE¼ sec. 21, T. 10 S., R. 3 E., detailed soil map unit 22-2A. The profile described formed in glacial till derived from sandstone. It is on a glacial moraine. The major habitat type is subalpine fir/blue huckleberry.

Range in Characteristics

The following data are based on the detailed descriptions of 19 pedons.

E horizon:

Hue—5YR, 10YR
Value—4 to 7, dry; 2 to 5, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—silt loam, loam, sandy loam, loamy sand
Content of rock fragments—5 to 50 percent
Reaction—4.0 to 7.3
Thickness—2 to 26 inches; average 10 inches

Bt horizon:

Hue—5YR, 10YR
Value—6 to 8, dry; 3 to 6, moist
Chroma—3 to 6, moist
Texture of the fine-earth fraction—clay loam, silty clay loam, sandy clay loam, silt loam, loam
Content of rock fragments—35 to 70 percent
Reaction—4.0 to 7.3
Thickness—6 to 41 inches; average 15 inches

BC or C horizon:

Hue—5YR, 10YR
Value—6 or 7, dry; 4 to 6, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—sandy clay loam, loam, sandy loam
Content of rock fragments—20 to 60 percent
Reaction—5.1 to 7.8

Eutroboralfs

Eutroboralfs are the cool, base-saturated Boralfs. The base saturation is 60 percent or more in the subsoil. Eutroboralfs are on south and southwesterly aspects below elevations of 7,500 feet. They are dry during late summer in most years. Regeneration of the forest is limited by moisture stress. Timber productivity is low. Forage productivity is moderate in areas of rangeland.

Mollic Eutroboralfs

Mollic Eutroboralfs are the Eutroboralfs that have a dark surface layer. They are the dominant soils in two map units in this survey. They are near the boundary between forest and grassland.

Mollic Eutroboralfs, Loamy-Skeletal, Mixed

Representative Pedon

E1—0 to 6 inches; pinkish gray (7.5YR 6/2) very gravelly silt loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; hard, firm, slightly sticky and slightly plastic; about 35 percent angular pebbles; slightly acid.

E2—6 to 8 inches; pinkish gray (7.5YR 6/2) very gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; about 40 percent angular pebbles; slightly acid.

BE—8 to 12 inches; pinkish gray (7.5YR 6/2) very gravelly clay loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; very hard, very firm, sticky and plastic; about 45 percent angular pebbles; slightly acid.

Bt—12 to 20 inches; pinkish gray (7.5YR 6/2) very gravelly clay loam, brown (7.5YR 4/2) moist; moderate very coarse subangular blocky structure; very hard, very firm, sticky and plastic; common prominent clay films on faces of peds; about 45 percent angular pebbles; slightly acid.

CB—20 to 60 inches; brown (7.5YR 5/2) very gravelly

silt loam, brown (7.5YR 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; about 45 percent angular pebbles; slightly acid.

Location and Setting

Southwestern Montana, Park County, Gallatin Range, Yellowstone River area, in the Dry Creek drainage area, NE¼ sec. 20 T. 4 S., R. 8 E., detailed soil map unit 54-3C. The profile described formed in material derived from volcanic rocks. It is on a steep mountain slope. The major habitat type is Douglas-fir/snowberry.

Range in Characteristics

The following data are based on the detailed descriptions of nine pedons.

E horizon:

Hue—7.5YR, 10YR
Value—4 to 7, dry; 3, moist
Chroma—1 to 3, moist
Texture of the fine-earth fraction—clay loam, loam, silt loam, sandy loam
Content of rock fragments—0 to 40 percent
Reaction—6.1 to 7.8
Thickness—2 to 12 inches; average 6 inches

Bt horizon:

Hue—7.5YR, 10YR
Value—4 to 6, dry; 3 to 5, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, silty clay loam, loam, silt loam
Content of rock fragments—40 to 60 percent
Reaction—6.1 to 7.8
Thickness—4 to 20 inches; average 11 inches

BC, C, or Ck horizon:

Hue—5YR to 10YR
Value—5 to 7, dry; 4 to 6, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, loam, silt loam, sandy loam
Content of rock fragments—40 to 80 percent
Reaction—6.6 to 8.3

Borolls

Borolls are cool and cold soils that have a dark surface layer. They are mainly on gentle slopes below an elevation of 8,500 feet. They generally are in areas of grassland.

Argiborolls

Argiborolls are cool Borolls that have an accumulation of clay in the subsoil. They are on south-facing slopes below elevations of 7,500 feet. Forage productivity is moderate in areas of these soils used as range.

Aridic Argiborolls

Aridic Argiborolls are the Argiborolls that are dry more than 60 percent of the growing season. They are the dominant soils in two map units in this survey. They are often associated with Typic Argiborolls. They are similar to, but drier than, Typic Argiborolls.

Aridic Argiborolls, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 9 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; about 20 percent angular pebbles; slightly acid.

Bt—9 to 26 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few distinct clay films on faces of peds; about 40 percent angular pebbles; slightly acid.

C—26 to 60 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; about 50 percent angular pebbles.

Location and Setting

Southwestern Montana, Park County, Gallatin Range, in the Big Creek drainage area, Cooper Bench, NW¼ sec. 23, T. 6 S., R. 7 E., detailed soil map unit 46-2A. The profile described formed in material derived from sandstone, limestone, and shale. It is on a gently sloping terrace. The vegetation consists of mountain grassland and mountain shrubland.

Range in Characteristics

The following data are based on the detailed descriptions of 11 pedons.

A horizon:

Value—3 or 4, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—clay loam, silt loam, sandy loam
Content of rock fragments—20 to 35 percent
Reaction—6.1 to 7.3
Thickness—5 to 16 inches; average 9 inches

Bt horizon:

Value—5 or 6, dry; 4 or 5, moist
Chroma—2 to 5, moist
Texture of the fine-earth fraction—clay loam, loam, sandy clay loam

Content of rock fragments—25 to 70 percent
Reaction—6.1 to 7.3
Thickness—6 to 42 inches; average 17 inches

C horizon:
Value—5 to 8, dry; 4 to 7, moist
Chroma—3 to 6, moist
Texture of the fine-earth fraction—sandy loam, loamy sand, sandy clay loam
Content of rock fragments—40 to 75 percent
Reaction—6.1 to 7.3

Pachic Argiborolls

Pachic Argiborolls are the Argiborolls that have a very thick, dark surface layer. They are the dominant soils in one map unit in this survey and are the dissimilar soils in many of the map units. They are in depressions that receive runoff and sediment from adjacent slopes. Forage productivity is high in areas of these soils used as range.

Pachic Argiborolls, Loamy-Skeletal, Mixed

Representative Pedon

A1—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; about 10 percent pebbles; slightly acid.

A2—12 to 20 inches; dark grayish brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; about 15 percent pebbles; slightly acid.

Bt1—20 to 30 inches; dark grayish brown (10YR 4/2) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; few faint clay films on faces of peds; about 35 percent pebbles and cobbles; slightly acid.

Bt2—30 to 37 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; common distinct clay films on faces of peds; about 45 percent cobbles; slightly acid.

BC—37 to 50 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, firm, sticky and plastic; about 45 percent cobbles; slightly acid.

CB—50 to 60 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; about 50 percent cobbles and stones; slightly acid.

Location and Setting

Southwestern Montana, Park County, Gallatin Range, Tom Miner Basin, Sunlight Creek, SE¼ sec. 23, T. 8 S., R. 5 E., detailed soil map unit 54-3A. The profile described formed in material derived from volcanic rocks. It is on a steep, dissected mountain slope. The vegetation consists of mountain grassland and mountain shrubland.

Range in Characteristics

The following data are based on the detailed descriptions of eight pedons.

A horizon:
Value—2 or 3, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—loam, silt loam
Content of rock fragments—0 to 15 percent
Reaction—6.1 to 8.4
Thickness—8 to 20 inches; average 14 inches

Bt horizon:
Value—4 or 5, dry; 3 to 5, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—clay loam, loam
Content of rock fragments—35 to 50 percent
Reaction—6.1 to 8.4
Thickness—8 to 30 inches; average 11 inches

BC or C horizon:
Value—4 or 5, dry; 3 to 5, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—clay loam, loam
Content of rock fragments—35 to 50 percent
Reaction—6.1 to 8.4
Thickness—10 to 34 inches

Typic Argiborolls

Typic Argiborolls represent the central concept, or typical member, of Argiborolls. They are in nine map units in this survey. They share a common boundary with Cryoborolls and Cryoboralfs. They are near the boundary between grassland and Douglas-fir forest. Timber productivity is low in areas of these soils. Forage productivity is moderate in areas of rangeland.

Typic Argiborolls, Fine-Loamy, Mixed

Representative Pedon

A1—0 to 5 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; about 5 percent pebbles; medium acid.

A2—5 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2)

moist; moderate coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; about 5 percent pebbles; medium acid.

A3—8 to 14 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; about 5 percent pebbles; medium acid.

Bt1—14 to 18 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, brown (10YR 4/3) moist; moderate coarse prismatic structure; hard, firm, sticky and plastic; few distinct clay films on faces of peds; about 20 percent pebbles; slightly acid.

Bt2—18 to 23 inches; yellowish brown (10YR 5/4) cobbly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; common distinct clay films on faces of peds; about 20 percent cobbles; slightly acid.

Bt3—23 to 26 inches; light yellowish brown (2.5Y 6/4) cobbly sandy clay loam, dark grayish brown (2.5Y 4/3) moist; strong medium subangular blocky structure; very hard, firm, slightly sticky and plastic; few faint clay films on faces of peds; about 20 percent cobbles; slightly acid,

BC—26 to 30 inches; light brownish gray (2.5Y 6/3) stony sandy clay loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure; very hard, very firm, slightly sticky and plastic; about 20 percent stones; slightly acid.

C—30 to 60 inches; brownish yellow (10YR 6/5) stony sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, sticky and plastic; about 20 percent stones; slightly acid.

Location and Setting

Southwestern Montana, Park County, Gallatin Range, Yellowstone River area, in the Big Creek drainage area, NW¼ sec. 23, T. 6 S., R. 7 E., detailed soil map unit 84-1B. The profile described formed in material derived from sandstone. It is on a structurally controlled slope. The major habitat type is big sagebrush/Idaho fescue.

Range in Characteristics

The following data are based on the detailed descriptions of four pedons.

A horizon:

Value—3 to 5, dry; 2 or 3, moist
Chroma—2, moist
Texture of the fine-earth fraction—silt loam, loam, sandy loam
Content of rock fragments—0 to 5 percent
Reaction—5.6 to 7.8
Thickness—3 to 16 inches; average 9 inches

Bt horizon:

Hue—10YR, 2.5Y
Value—4 to 6, dry; 3 or 4, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—clay loam, sandy clay loam, silt loam, loam, sandy loam
Content of rock fragments—0 to 20 percent
Reaction—5.6 to 7.3
Thickness—8 to 14 inches; average 12 inches

BC or C horizon:

Hue—10YR, 2.5Y
Value—4 to 6, dry; 4 or 5, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, sandy clay loam, loam, sandy loam
Content of rock fragments—0 to 30 percent
Reaction—5.6 to 7.8

Typic Argiborolls, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and slightly plastic; about 10 percent pebbles; mildly alkaline.

Bt1—8 to 14 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, brown (10YR 4/3) moist; moderate coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few distinct clay films on faces of peds; about 50 percent pebbles; moderately alkaline.

Bt2—14 to 18 inches; light yellowish brown (10YR 6/4) very gravelly silty clay loam, light yellowish brown (10YR 6/4) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few faint clay films on faces of peds; about 50 percent pebbles; moderately alkaline.

Ck—18 to 60 inches; light yellowish brown (10YR 6/4) very cobbly silt loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; few soft accumulations of calcium carbonate; about 65 percent cobbles; moderately alkaline.

Location and Setting

Southwestern Montana, Gallatin County, Gallatin Canyon, in the Porcupine Game Range area, NE¼ sec. 32, T. 6 S., R. 4 E., detailed soil map unit 54-2D. The profile described formed in material derived from interbedded sandstone and shale. It is on the toe of a

deposit from a landslide. The major habitat type is big sagebrush/Idaho fescue.

Range in Characteristics

The following data are based on the detailed descriptions of seven pedons.

A horizon:
Value—3 to 5, dry; 2 or 3, moist
Chroma—1 or 2, moist
Texture of the fine-earth fraction—silt loam, loam, sandy loam
Content of rock fragments—10 to 20 percent
Reaction—6.6 to 7.8
Thickness—4 to 13 inches; average 8 inches

Bt horizon:
Value—5 or 6, dry; 3 to 6, moist
Chroma—3 or 4, moist
Texture of the fine-earth fraction—silty clay loam, clay loam, silt loam, loam
Content of rock fragments—38 to 50 percent
Reaction—6.6 to 8.4
Thickness—8 to 10 inches; average 8 inches

C or Ck horizon:
Value—6, dry; 4 to 6, moist
Texture of the fine-earth fraction—clay loam, silt loam, loam
Content of rock fragments—40 to 65 percent
Reaction—6.6 to 8.4

Calciborolls

Calciborolls are the cool, calcareous Borolls. They formed in material derived from limestone bedrock. They tend to be on south-facing slopes, on steep slopes, and in areas of grassland or Douglas-fir forest. In areas of these soils, the productivity of forest and range is limited by moisture stress.

Typic Calciborolls

Typic Calciborolls represent the central concept, or typical member, of Calciborolls. They are the dominant soils in four map units in this survey. They are associated with Typic Argiborolls and Typic Ustochrepts.

Typic Calciborolls, Loamy-Skeletal, Carbonatic

Representative Pedon

A1—0 to 8 inches; dark grayish brown (10YR 4/2) very gravelly silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; about 40 percent limestone pebbles; strongly effervescent; moderately alkaline.

A2—8 to 20 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; about 40 percent limestone pebbles; strongly effervescent; moderately alkaline.

Bk—20 to 27 inches; pale brown (10YR 6/3) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, friable; slightly sticky and slightly plastic; about 55 percent limestone pebbles; common soft accumulations of calcium carbonate; violently effervescent; moderately alkaline.

Ck—27 to 60 inches; very pale brown (10YR 7/3) extremely cobbly sandy loam, brown (10YR 5/3) moist; massive; soft, friable, nonsticky and nonplastic; about 70 percent limestone cobbles; many soft accumulations of calcium carbonate; violently effervescent; moderately alkaline.

Location and Setting

Southwestern Montana, Gallatin County, Hebgen Lake area, in the Johnson Creek drainage area, SW¼NW¼ sec. 4, T. 12 S., R. 4 E., detailed soil map unit 54-2B. The profile described formed in material derived from limestone. It is on a steep mountain slope. The major habitat type is Douglas-fir/snowberry.

Range in Characteristics

The following data are based on the detailed descriptions of six pedons.

A horizon:
Value—2 or 3, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—silty clay loam, silt loam, loam, sandy loam
Content of rock fragments—30 to 60 percent
Reaction—7.9 to 8.4
Thickness—7 to 20 inches; average 11 inches

Bk horizon:
Value—5 or 6, dry; 4 or 5, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—loam, silt loam, sandy loam
Content of rock fragments—35 to 60 percent
Reaction—7.9 to 8.4
Thickness—5 to 12 inches; average 8 inches

Ck horizon:
Value—6 or 7, dry; 4 or 5, moist
Chroma—3 or 4, moist
Texture of the fine-earth fraction—loam, sandy loam
Content of rock fragments—35 to 70 percent
Reaction—7.9 to 8.4

Cryoborolls

Cryoborolls are the cold Borolls of high elevations. They are moderately productive as range sites.

Argic Cryoborolls

Argic Cryoborolls are the Cryoborolls that have an accumulation of clay in the subsoil. They are the dominant soils in 32 map units in this survey. They formed in material derived from interbedded sandstone and shale and volcanic rocks. They are associated with Cryoboralfs in areas near the boundary of forests and grasslands and with Argic Pachic Cryoborolls and Typic Cryoborolls in areas of mountain meadows.

Argic Cryoborolls, Fine-Loamy, Mixed

Representative Pedon

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and slightly plastic; slightly acid.

A2—4 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; slightly acid.

Bt1—10 to 18 inches; pale brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) moist; weak or moderate medium prismatic structure; hard, firm, sticky and plastic; common prominent clay films on faces of peds; slightly acid.

Bt2—18 to 26 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak or moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; many prominent clay films on faces of peds; slightly acid.

Bt3—26 to 32 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common prominent clay films on faces of peds; slightly acid.

C1—32 to 44 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; massive; very hard, very firm, sticky and plastic; slightly acid.

C2—44 to 60 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; massive; very hard, very firm, sticky and plastic; about 20 percent pebbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Bridger Mountains, Bridger Creek area, SE¼ sec. 36, T. 1 N., R. 6 E., detailed soil map unit 87-2E. The profile described formed in material derived from siltstone and shale. It is on a structurally controlled slope. The major habitat type is subalpine fir/whitebark pine/grouse whortleberry.

Range in Characteristics

The following data are based on the detailed descriptions of 33 pedons.

A horizon:
- Value—4 or 5, dry; 2 or 3, moist
- Chroma—1 to 3, moist
- Texture of the fine-earth fraction—loam, silt loam
- Content of rock fragments—0 to 15 percent
- Reaction—6.1 to 7.8
- Thickness—4 to 14 inches; average 8 inches

Bt horizon:
- Hue—5YR to 10YR
- Value—4 to 6, dry; 3 to 5, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—silty clay loam, clay loam, silt loam
- Content of rock fragments—0 to 25 percent
- Reaction—6.1 to 7.8
- Thickness—6 to 24 inches; average 15 inches

C horizon:
- Hue—2.5YR to 10YR
- Value—4 to 6, dry; 4 or 5, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—clay loam, loam, silt loam
- Content of rock fragments—0 to 20 percent
- Reaction—6.1 to 8.4

Argic Cryoborolls, Fine, Mixed

Representative Pedon

A—0 to 10 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; about 5 percent pebbles; medium acid.

E—10 to 20 inches; light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and slightly plastic; about 10 percent pebbles; medium acid.

Bt—20 to 28 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; strong medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common distinct clay films on faces of peds; about 10 percent pebbles; medium acid.

C1—28 to 35 inches; light yellowish brown (10YR 6/5) gravelly sandy clay loam, yellowish brown (10YR 5/5) moist; massive; very hard, very firm, sticky and plastic; about 30 percent pebbles and cobbles; medium acid.

C2—35 to 60 inches; light yellowish brown (10YR 6/5) cobbly loam, yellowish brown (10YR 5/5) moist; massive; very hard, very firm, sticky and plastic; about 10 percent cobbles; medium acid.

Location and Setting

Southwestern Montana, Sweetgrass County, Crazy Mountains, South Fork, in the American Fork drainage area, NW¼ sec. 29, T. 5 N., R. 12 E., detailed soil map unit 84-1A. The profile described formed in material derived from shale. It is on a structurally controlled slope. The major habitat type is subalpine fir/blue huckleberry.

Range in Characteristics

The following data are based on the detailed descriptions of 20 pedons.

A horizon:

Hue—5YR to 10YR
Value—3 to 5, dry; 2 or 3, moist
Chroma—1 to 3, moist
Texture of the fine-earth fraction—silty clay loam, clay loam, loam, silt loam
Content of rock fragments—0 to 20 percent
Reaction—5.6 to 7.3
Thickness—4 to 12 inches; average 8 inches

B horizon:

Hue—2.5YR to 2.5Y
Value—5 or 6, dry; 3 to 5, moist
Chroma—1 to 6, moist
Texture of the fine-earth fraction—clay, silty clay, silty clay loam, clay loam
Content of rock fragments—0 to 30 percent
Reaction—5.6 to 7.3
Thickness—5 to 40 inches; average 13 inches

C horizon:

Hue—2.5YR to 2.5Y
Value—4 or 5, moist
Chroma—2 to 5, moist
Texture of the fine-earth fraction—silty clay loam, sandy clay loam, loam
Content of rock fragments—0 to 40 percent
Reaction—5.6 to 8.4

Argic Cryoborolls, Loamy-Skeletal, Mixed

Representative Pedon

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, friable, sticky and slightly plastic; slightly acid.

A2—3 to 10 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; slightly hard, friable, sticky and slightly plastic; slightly acid.

Bt1—10 to 15 inches; pale brown (10YR 6/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; slightly hard, firm, sticky and plastic; common distinct clay films on faces of peds; medium acid.

Bt2—15 to 25 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 4/3) moist; weak or moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; common distinct clay films on faces of peds; about 50 percent pebbles and cobbles; slightly acid.

Bt3—25 to 40 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few distinct clay films on faces of peds; about 50 percent pebbles and cobbles; slightly acid.

BC—40 to 52 inches; light yellowish brown (10YR 6/4) very cobbly loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; about 50 percent cobbles; slightly acid.

C—52 to 60 inches; light yellowish brown (10YR 6/4) very cobbly loam, brown (10YR 5/3) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; about 50 percent cobbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Hebgen Lake area, in the Beaver Creek drainage area, NW¼ sec. 21, T. 11 S., R. 3 E., detailed soil map unit 34-1B. The profile described formed in glacial drift. The vegetation is mountain shrubland.

Range in Characteristics

The following data are based on the detailed descriptions of 25 pedons.

A horizon:

Value—3 to 5, dry; 2 or 3, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—loam, silt loam, sandy loam
Content of rock fragments—0 to 40 percent
Reaction—5.6 to 7.3
Thickness—10 to 16 inches; average 12 inches

Bt horizon:

Hue—5YR to 10YR
Value—4 to 6, dry; 3 to 5, moist

Chroma—2 to 4, moist
Texture of the fine-earth fraction—loam, silty clay loam, sandy clay loam, loam, silt loam, sandy loam
Content of rock fragments—35 to 60 percent
Reaction—5.6 to 7.8
Thickness—8 to 30 inches; average 12 inches

BC or C horizon:
Hue—2.5YR to 10YR
Value—4 to 6, dry; 3 to 5, moist
Chroma—3 or 4, moist
Texture of the fine-earth fraction—clay loam, loam, sandy loam
Content of rock fragments—35 to 60 percent
Reaction—6.6 to 8.4

Argic Pachic Cryoborolls

Argic Pachic Cryoborolls are the Cryoborolls that have a very thick, dark surface layer and an accumulation of clay in the subsoil. They are the dominant soils in five map units in this survey and are the dissimilar soils in many other units. They are in depressions where runoff and sediment from adjacent slopes collect. Forage productivity is very high in areas of these soils used as rangeland.

Argic Pachic Cryoborolls, Fine-Loamy, Mixed

Representative Pedon

A—0 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure; slightly hard, friable, nonsticky and nonplastic; slightly acid.

Bt1—9 to 16 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; neutral.

Bt2—16 to 22 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many prominent clay films on faces of peds; neutral.

Bt3—22 to 28 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many distinct clay films on faces of peds; neutral.

BC—28 to 40 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; neutral.

C—40 to 60 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; hard, firm, slightly sticky and slightly plastic; neutral.

Location and Setting

Southwestern Montana, Gallatin County, Bridger Mountains, in the Cache Creek drainage area, Fairy Lake Road, NE¼ sec. 24, T. 2 N., R. 6 E., detailed soil map unit 34-4C. The profile described formed in material derived from shale and siltstone. It is in a swale on a gentle sloping, structurally controlled slope. The vegetation is mountain shrubland.

Range in Characteristics

The following data are based on the detailed descriptions of 29 pedons.

A horizon:
Value—3 to 5, dry; 2 or 3, moist
Chroma—1 to 3, moist
Texture of the fine-earth fraction—loam, silt loam, sandy loam
Content of rock fragments—0 to 10 percent
Reaction—6.1 to 7.3
Thickness—7 to 24 inches; average 12 inches

Bt horizon:
Value—3 to 6, dry; 2 to 4, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, sandy clay loam, loam, silt loam
Content of rock fragments—0 to 25 percent
Reaction—6.6 to 8.4
Thickness—9 to 22 inches; average 14 inches

BC or C horizon:
Value—3 to 6, dry; 2 to 4, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, sandy clay loam, loam, silt loam
Content of rock fragments—0 to 25 percent
Reaction—6.6 to 8.4
Thickness—14 to 44 inches

Argic Pachic Cryoborolls, Loamy-Skeletal, Mixed

Representative Pedon

A1—0 to 7 inches; brown (10YR 5/3) gravelly loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; about 25 percent pebbles; medium acid.

A2—7 to 12 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and nonplastic; about 30 percent pebbles; medium acid.

Bt—12 to 18 inches; brown (10YR 5/3) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak or moderate subangular blocky structure; soft

and slightly hard, very friable and friable, slightly sticky and nonplastic; few faint clay films on faces of peds; about 40 percent pebbles; slightly acid.

BC1—18 to 25 inches; brown (10YR 5/3) very cobbly sandy loam, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; about 40 percent cobbles; slightly acid.

BC2—25 to 31 inches; yellowish brown (10YR 5/4) very cobbly sandy loam, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; about 40 percent cobbles; slightly acid.

C—31 to 60 inches; light yellowish brown (10YR 6/4) very stony sandy loam, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; about 50 percent stones; neutral.

Location and Setting

Southwestern Montana, Park County, Crazy Mountains, Middle Fork of Big Timber Creek, NE¼ sec. 23, T. 3 N., R. 12 E., detailed soil map unit 35-1B. The profile described formed in glacial drift derived from granitic rocks. The major habitat type is low sagebrush/ Idaho fescue.

Range in Characteristics

The following data are based on the detailed descriptions of 15 pedons.

A horizon:
- Hue—5YR to 10YR
- Value—4 or 5, dry; 2 or 3, moist
- Chroma—1 to 3, moist
- Texture of the fine-earth fraction—loam, silt loam, sandy loam
- Content of rock fragments—15 to 40 percent
- Reaction—5.6 to 7.8
- Thickness—6 to 24 inches; average 14 inches

Bt horizon:
- Hue—5YR to 10YR
- Value—4 or 5, dry; 2 to 4, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—silty clay loam, sandy clay loam, loam, silt loam
- Content of rock fragments—35 to 60 percent
- Reaction—5.6 to 7.8
- Thickness—6 to 22 inches; average 17 inches

BC or C horizon:
- Hue—2.5YR to 10YR
- Value—5 or 6, dry; 4 or 5, moist
- Chroma—2 to 4, moist
- Texture of the fine-earth fraction—sandy clay loam, loam, sandy loam, silt loam
- Content of rock fragments—40 to 60 percent
- Reaction—6.1 to 8.4

Typic Cryoborolls

Typic Cryoborolls represent the central concept, or typical member, of Cryoborolls. They are the dominant soils in seven map units. They are associated with Argic Cryoborolls and Typic Cryochrepts. Their parent material has a low content of clay. An example of the parent material is that derived from granitic rocks. These soils are in loamy-skeletal or coarser textured families. Forage productivity is moderate in areas of these soils used as rangeland.

Typic Cryoborolls, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 7 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable, nonsticky and nonplastic; medium acid.

Bw1—7 to 16 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam, dark grayish brown (10YR 4/2) moist; very weak fine granular structure; loose, friable, slightly sticky and nonplastic; about 45 percent pebbles; medium acid.

Bw2—16 to 22 inches; dark grayish brown (10YR 4/2) very cobbly sandy loam, dark grayish brown (10YR 4/2) moist; very weak fine granular structure; loose, friable, nonsticky and nonplastic; about 45 percent cobbles; slightly acid.

C—22 to 60 inches; grayish brown (10YR 5/2) very cobbly sandy loam, dark grayish brown (10YR 4/2) moist; massive; loose, friable, slightly sticky and slightly plastic; about 50 percent cobbles; slightly acid.

Location and Setting

Southwestern Montana, Madison County, Hebgen Lake area, in the Sheep Creek drainage area, NW¼NE¼ sec. 7, T. 12 S., R. 3 E., detailed soil map unit 54-1B. The profile described formed in material derived from granitic rock. It is on a steep, dissected mountain slope. The vegetation is lower subalpine forest.

Range in Characteristics

The following data are based on the detailed descriptions of 14 pedons.

A horizon:
- Value—4 or 5, dry; 2 or 3, moist
- Chroma—2 or 3, moist
- Texture of the fine-earth fraction—silt loam, loam, sandy loam
- Content of rock fragments—0 to 50 percent
- Reaction—5.6 to 7.3
- Thickness—4 to 14 inches; average 8 inches

B horizon:
Value—4 to 7, dry; 3 or 4, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—loam, silt loam, sandy loam
Content of rock fragments—35 to 70 percent
Reaction—5.6 to 7.3
Thickness—4 to 15 inches; average 8 inches

C horizon:
Value—5 or 6, dry; 4, moist
Chroma—2 to 5, moist
Texture of the fine-earth fraction—loam, sandy loam
Content of rock fragments—35 to 50 percent
Reaction—5.6 to 6.5

Haploborolls

Haploborolls are cool Borolls that do not have an accumulation of clay in the subsoil. They formed in material derived from granitic rocks or sandstone. They are on steep, south-facing slopes at the lower elevations. They are in areas of grassland or Douglas-fir forest near the boundary of the forest and grassland. Forage production is moderate in areas of rangeland, but the slope limits access by livestock. In forested areas of these soils, timber productivity is low and regeneration is limited by moisture stress and plant competition.

Typic Haploborolls

Typic Haploborolls represent the central concept, or typical member, of the Haploborolls. They are the dominant soils in two map units in this survey. They are associated with Typic Ustochrepts.

Typic Haploborolls, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 9 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; about 55 percent pebbles; medium acid.

AB—9 to 14 inches; brown (10YR 5/3) very gravelly loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; about 50 percent pebbles; medium acid.

Bw1—14 to 18 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, sticky and slightly plastic; about 50 percent pebbles; medium acid.

Bw2—18 to 24 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, friable, sticky and slightly plastic; about 50 percent pebbles; medium acid.

BC—24 to 60 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, friable, sticky and slightly plastic; about 50 percent pebbles; neutral.

Location and Setting

Southwestern Montana, Gallatin County, Bridger Mountains, in the Cottonwood Creek drainage area, NE¼ sec. 4, T. 1 S., R. 6 E., detailed soil map unit 54-1A. The profile described formed in material derived from granitic rocks. It is on a mountain slope. The major habitat type is Idaho fescue/bluebunch wheatgrass.

Range in Characteristics

The following data are based on the detailed descriptions of seven pedons.

A horizon:
Value—4 or 5, dry; 2 or 3, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—silty clay loam, silt loam, loam, sandy loam
Content of rock fragments—0 to 55 percent
Reaction—5.6 to 7.3
Thickness—7 to 14 inches; average 10 inches

B horizon:
Value—5 or 6, dry; 3 or 4, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—sandy clay loam, silt loam, loam, sandy loam
Content of rock fragments—40 to 55 percent
Reaction—5.6 to 8.4
Thickness—10 to 29 inches; average 14 inches

BC or C horizon:
Value—5 or 6, dry; 4 or 5, moist
Texture of the fine-earth fraction—loam, sandy loam
Content of rock fragments—50 to 60 percent
Reaction—6.6 to 8.4

Ochrepts

Ochrepts are soils having a light colored surface layer and not having an accumulation of clay in the subsoil. They are mainly on steep slopes. They formed in material derived from granitic and rhyolitic rocks. They mainly are in forested areas.

Cryochrepts

Cryochrepts are the cold Ochrepts. They are above elevations of 6,500 feet.

Dystric Cryochrepts

Dystric Cryochrepts are the Cryochrepts that have low base saturation in the subsoil. They are the dominant soils in seven map units in the survey. They formed in material derived from granitic or rhyolitic rocks. They are in areas of upper subalpine forest and alpine meadows. They generally are at elevations of more than 8,200 feet. In areas of these soils, timber productivity is low and very low and regeneration of the forest is limited by the harsh subalpine climate.

Dystric Cryochrepts, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 4 inches; light brownish gray (10YR 6/2) very gravelly loam, brown (10YR 4/2) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; about 40 percent pebbles; medium acid.

Bw—4 to 12 inches; light brownish gray (10YR 6/2) very gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; soft, friable, nonsticky and slightly plastic; about 40 percent pebbles; medium acid.

BC—12 to 18 inches; light gray (10YR 7/2) very cobbly loam, pale brown (10YR 6/3) moist; weak moderate subangular blocky structure; soft, friable, nonsticky and slightly plastic; about 55 percent cobbles; medium acid.

C—18 to 40 inches; white (10YR 8/2) very cobbly loam, pale brown (10YR 6/3) moist; massive; soft, nonsticky and slightly plastic; about 55 percent cobbles; medium acid.

R—40 inches; weathered rhyolite.

Location and Setting

Southwestern Montana, Gallatin County, Madison Range (Hilgards), north of Hebgen Lake, in the Grayling Creek drainage area, NE¼ sec. 4, T. 12 S., R. 5 E., detailed soil map unit 54-1E. The profile described formed in material derived from rhyolite. It is on a mountain slope. The major habitat type is subalpine fir/whitebark pine/grouse whortleberry.

Range in Characteristics

The following data are based on the detailed descriptions of 14 pedons.

A horizon:

Hue—7.5YR, 10YR
Value—5 or 6, dry; 3 to 5, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—silt loam, loam, sandy loam
Content of rock fragments—35 to 70 percent
Reaction—5.1 to 6.0
Thickness—2 to 14 inches; average 8 inches

Bw horizon:

Hue—7.5YR, 10YR
Value—6 or 7, dry; 2 to 5, moist
Chroma—2 or 3, moist
Texture of the fine-earth fraction—silt loam, loam, sandy loam
Content of rock fragments—35 to 70 percent
Reaction—5.6 to 6.0
Thickness—8 to 11 inches; average 10 inches

BC horizon:

Value—7, dry; 5 or 6, moist
Texture of the fine-earth fraction—loam, sandy loam
Content of rock fragments—40 to 70 percent
Reaction—5.6 to 6.5
Thickness—6 to 12 inches; average 9 inches

C horizon:

Value—7 or 8, dry; 5 or 6, dry
Texture of the fine-earth fraction—loam, silt loam, sandy loam
Content of rock fragments—40 to 60 percent
Reaction—5.6 to 6.5

Dystric Cryochrepts, Sandy-Skeletal, Mixed

Representative Pedon

A1—0 to 1 inch; light gray (10YR 7/2) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; about 10 percent pebbles; strongly acid.

2A2—1 to 7 inches; pale brown (10YR 6/3) very cobbly sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; about 40 percent cobbles; strongly acid.

2Bw—7 to 16 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; about 35 percent pebbles; medium acid.

2CB—16 to 40 inches; light yellowish brown (10YR 6/4) very cobbly loamy sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; about 40 percent cobbles; slightly acid.

2C—40 to 60 inches; light yellowish brown (10YR 6/4) very cobbly loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; about 60 percent cobbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Gallatin Range, in the Upper Goose Creek drainage area, SW¼ sec. 36, T. 6 S., R. 4 E., detailed soil map unit 13-1A. The profile described formed in material derived from

granitic rocks. It is on a mountain ridge. The major habitat type is Idaho fescue/tufted hairgrass.

Range in Characteristics

The following data are based on the detailed descriptions of four pedons.

A horizon:
- Value—5 to 7, dry; 3 or 4, moist
- Texture of the fine-earth fraction—silt loam, loam, sandy loam
- Content of rock fragments—10 to 65 percent
- Reaction—5.1 to 6.0
- Thickness—3 to 7 inches; average 5 inches

Bw horizon:
- Hue—7.5YR to 2.5YR
- Value—5 to 7, dry; 4 or 5, moist
- Texture of the fine-earth fraction—loam, sandy loam
- Content of rock fragments—35 to 65 percent
- Reaction—5.6 to 6.0
- Thickness—9 to 18 inches; average 15 inches

CB or C horizon:
- Value—6 or 7, dry; 4 or 5, moist
- Texture of the fine-earth fraction—sandy loam, loamy sand
- Content of rock fragments—35 to 65 percent
- Reaction—5.6 to 6.5

Typic Cryochrepts

Typic Cryochrepts represent the central concept, or typical member, of Cryochrepts. They are the dominant soils in 23 map units in this survey. They formed in moderately coarse textured material derived from granitic rocks or sandstone that is high in silica. As a result, they are less fertile than finer textured soils. In this survey area they are at the warmer end of the temperature regime. Timber productivity is low in areas of these soils.

Typic Cryochrepts, Loamy-Skeletal, Mixed

Representative Pedon

A—0 to 3 inches; brown (10YR 5/3) gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; about 15 percent pebbles; strongly acid.

Bw—3 to 16 inches; very pale brown (10YR 7/3) very cobbly sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; about 50 percent cobbles; medium acid.

BC—16 to 32 inches; very pale brown (10YR 7/3) extremely cobbly sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, friable, slightly sticky and slightly plastic; about 65 percent cobbles; slightly acid.

C—32 to 60 inches; very pale brown (10YR 7/4) extremely cobbly sandy loam, yellowish brown (10YR 5/4) moist; massive; loose, friable, slightly sticky and slightly plastic; about 65 percent cobbles; neutral.

Location and Setting

Southwestern Montana, Park County, Crazy Mountains, Ibex Mountain area, in the South Fork Horsefly Creek drainage area, NW¼ sec. 12, T. 3 N., R. 10 E., detailed soil map unit 54-1G. The profile described formed in glacial till derived from granitic rocks. It is on a mountain slope. The major habitat type is subalpine fir/blue huckleberry.

Range in Characteristics

The following data are based on the detailed descriptions of 20 pedons.

A horizon:
- Hue—7.5YR, 10YR
- Value—5 or 6, dry; 3 or 4, moist
- Chroma—2 or 3, moist
- Texture of the fine-earth fraction—silt loam, loam, sandy loam
- Content of rock fragments—10 to 50 percent
- Reaction—5.1 to 8.4
- Thickness—2 to 9 inches; average 7 inches

Bw horizon:
- Hue—5YR to 10YR
- Value—6 or 7, dry; 4 or 5, moist
- Chroma—3 or 4, moist
- Texture of the fine-earth fraction—clay loam, loam, sandy loam
- Content of rock fragments—35 to 50 percent
- Reaction—5.1 to 8.4
- Thickness—5 to 33 inches; average 13 inches

BC horizon:
- Hue—7.5YR, 10YR
- Value—6 or 7, dry; 5, moist
- Chroma—3 or 4, moist
- Texture of the fine-earth fraction—loam, sandy loam
- Content of rock fragments—35 to 65 percent
- Reaction—5.1 to 8.4
- Thickness—6 to 32 inches; average 13 inches

C horizon:
- Hue—10YR, 7.5YR
- Value—6 or 7, dry; 4 or 5, moist
- Chroma—2 to 6, moist
- Texture of the fine-earth fraction—clay loam, sandy

clay loam, loam, very fine sandy loam
Content of rock fragments—35 to 80 percent
Reaction—5.1 to 8.4

Typic Cryochrepts, Sandy-Skeletal, Siliceous

Representative Pedon

A—0 to 5 inches; pale brown (10YR 6/3) coarse sandy loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; very strongly acid.

Bw—5 to 12 inches; pale brown (10YR 6/3) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; about 40 percent pebbles; medium acid.

CB—12 to 22 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; about 45 percent pebbles; slightly acid.

C—22 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; about 50 percent pebbles; slightly acid.

Location and Setting

Southwestern Montana, Gallatin County, Hebgen Lake area, south of West Yellowstone, SW¼ sec. 34, T. 13 S., R. 5 E., detailed soil map unit 46-3A. The profile described formed in glacial outwash derived from obsidian and rhyolite flows. The major habitat type is lodgepole pine/bitterbrush.

Range in Characteristics

The following data are based on the detailed descriptions of two pedons.

A horizon:
Value—3 or 4, moist
Chroma—2 or 3, moist
Content of rock fragments—0 to 25 percent
Reaction—4.5 to 6.5
Thickness—2 to 5 inches; average 4 inches

Bw horizon:
Value—4 or 5, moist
Chroma—3 or 4, moist
Content of rock fragments—35 to 45 percent
Reaction—5.6 to 6.5
Thickness—7 or 8 inches; average 8 inches

CB or C horizon:
Texture of the fine-earth fraction—loamy coarse sand, coarse sand
Content of rock fragments—40 to 50 percent
Reaction—6.1 to 7.3

Ustochrepts

Ustochrepts are the Ochrepts of a warm, dry climate. In this survey area they are on steep, south-facing slopes at the lower elevations. They are in areas of Douglas-fir forest and mountain grassland. Forage production is moderate in areas of rangeland, but the slope limits access by livestock. Timber productivity is low in the Douglas-fir forest, and regeneration of the forest is limited by moisture stress and plant competition.

Typic Ustochrepts

Typic Ustochrepts represent the central concept, or typical member, of Ustochrepts. They are the dominant soils in five map units in this survey. They are associated with Typic Calciborolls, Typic Argiborolls, and Typic Haploborolls.

Typic Ustochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

A1—0 to 3 inches; light brownish gray (10YR 6/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral.

A2—3 to 6 inches; light brownish gray (10YR 6/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; about 25 percent pebbles; neutral.

BA—6 to 8 inches; brown (7.5YR 5/3) very gravelly clay loam, dark brown (7.5YR 3.2) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; about 40 percent pebbles; mildly alkaline.

Bw—8 to 19 inches; yellowish red (5YR 4/5) very cobbly sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; about 55 percent cobbles; moderately alkaline.

Ck—19 to 60 inches; light reddish brown (5YR 6/4) very cobbly clay loam, reddish brown (5YR 4/4) moist; massive; hard, firm, sticky and plastic; about 55 percent cobbles; violently effervescent; soft segregations of carbonate; moderately alkaline.

Location and Setting

Southwestern Montana, Gallatin County, Bridger Range, Limestone Canyon, SW¼ sec. 33, T. 2 N., R. 6 E., detailed soil map unit 54-2D. The profile described formed in material derived from interbedded sandstone and shale. It is on a mountain slope. The major habitat type is Douglas-fir/snowberry.

Range in Characteristics

The following data are based on the detailed descriptions of four pedons.

A or BA horizon:

Hue—7.5YR, 10YR
Value—5 or 6, dry; 3 or 4, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, silty clay loam, silt loam
Content of rock fragments—0 to 55 percent
Reaction—6.6 to 7.3
Thickness—2 to 12 inches; average 8 inches

Bw horizon:

Hue—5YR to 10YR
Value—4 or 5, dry; 3 or 4, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, silt loam, loam
Content of rock fragments—35 to 55 percent
Reaction—6.6 to 8.4
Thickness—10 to 18 inches; average 14 inches

Ck horizon:

Hue—5YR to 10YR
Value—4 to 7, dry; 4 to 6, moist
Chroma—2 to 4, moist
Texture of the fine-earth fraction—clay loam, sandy clay loam, loam, sandy loam
Content of rock fragments—40 to 55 percent
Reaction—7.4 to 8.4

Formation of the Soils

Five principal factors affect soil formation. They are parent material, topography, biological activity, climate, and time. These soil-forming factors are interdependent; each modifies the effects of the others.

Soil is formed through the combined effects of these five factors. The differences in soils are mainly due to the relative importance or strength of the various factors. In mountainous areas, such as Gallatin National Forest, changes in one or more soil-forming factors occur within relatively short distances. The many microclimates that result from change in elevation, air drainage, topography, slope, and aspect strongly influence soil formation. Complexity of the parent material, topography, and time also influence the kinds of soil that form in the area.

Some relationships between soil properties, parent material, and climate are obvious in the survey area. Soils that formed in material weathered from hard crystalline rocks or sandstone tend to be moderately coarse textured. They generally are low in fertility and are droughty. Soils that formed in material weathered from volcanic rocks are medium textured and moderately fine textured. They are higher in fertility and hold more moisture than the soils that formed in material weathered from hard crystalline rocks or sandstone. Soils that formed in material weathered from interbedded sandstone and shale tend to be medium textured. Some soils are fine textured if they are weathered from soft shale. If soft shale and sandstone are interbedded, however, the soils are medium textured because the weathered material is mixed. Soils that formed in obsidian sand near West Yellowstone are coarse textured. They are the least fertile soils in the survey area. The soils on most landslides tend to be moderately fine textured, possibly because the parent material generally is derived from shale and sandstone. Glacial till that is derived primarily from hard crystalline rocks generally is moderately coarse textured.

The climate in the survey area has fluctuated many times in the last million years. At times, it has been drier or wetter and warmer or cooler than it is at present. During the driest periods, only a few areas appear to have been forested. These areas are probably the moistest, most densely forested sites today. In the last 15,000 years, the tree line has ranged from an elevation of 7,000 to 9,500 feet.

The boundary between forests and grassland has been fluctuating for thousands of years. Soil properties change more slowly than vegetation. Therefore, many soils have properties inherited from an earlier vegetative cover. For example, some soils in the survey area have a surface layer that appears to have formed under both grassland and forest. Forests in areas of these soils are often difficult to regenerate.

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Glossary

Alluvial. Pertaining to material or processes associated with transportation or deposition by running water.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alpine. Characteristic of high mountains, especially ones modified by intense glacial erosion. Implies high elevation and cold climate,

Alpine turf. A class of vegetation consisting of low-growing forbs and grasses associated with a harsh climate at the higher elevations.

Aquic moisture regime. A reducing regime that is virtually free of dissolved oxygen because the soil is saturated by ground water.

Arterial road. A forest road that services large areas of land and usually connects with public highways or other arterial roads to form an integrated network of primary travel routes.

Association. A map unit in which two or more geographically associated soils or miscellaneous areas are shown as one unit on the maps. The components could have been mapped separately at the scale of mapping but it was not necessary to do so to meet the survey objectives.

Avalanche chute. The flow pathway along which an avalanche moves, often forming a long, narrow channel on a steep mountain slope.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Braided stream. A stream that divides into or follows an interlacing or tangled network of several small branching and reuniting shallow channels.

Clearcut. A silvicultural forest regeneration method where all trees on a site are removed at one time.

Cobble. A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Collector road. A forest road that connects traffic to an arterial road and serves a smaller area of land.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Cryic soil temperature regime. A soil temperature regime in which the mean annual soil temperature at a depth of 50 centimeters is higher than 0 degrees C but lower than 8 degrees C and the mean summer temperature is lower than 8 degrees C if an O horizon is present.

Cuesta. An asymmetric ridge with one face (dip slope) long and gentle and conforming with the dip of the underlying bed or beds that form it, and the opposite face (scarp slope) steep or even clifflike and formed by the outcrop of the resistant rocks.

Delineation. A single enclosed area within a drawn boundary line on a map. A single occurrence of a map unit.

Dip slope. A land slope roughly conforming to and controlled by the angle of inclination (dip) of the underlying rock.

Dissected slope. A slope with deeply cut drainageways at frequent intervals. The drainageways are deep enough to create a significant change in management recommendations when compared to a similar slope without observable dissections.

Entrenched stream. A stream that flows in a narrow trench, or valley, cut into a side slope or plain.

Fault scarp. A steep slope formed directly by movement along one side of a fault.

Flood plain. The land bordering a stream or river. It is built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Flow plateau. A comparatively flat, extensive area considerably elevated (more than 500 feet) above the adjacent land. It is supported by an underlying extensive volcanic flow.

Frigid soil temperature regime. A soil temperature regime in which the soil at a depth of 50 centimeters has a mean soil temperature of 0 degrees C to 8 degrees C and a mean summer

temperature equal to or more than 8 degrees C if the soil has an O horizon. The difference between mean winter and mean summer temperatures must be more than 5 degrees C. Summer mean temperatures are more than 15 degrees C if the soil does not have an O horizon.

Frost wedges. A term used loosely for any ice wedge, whether in perennially or seasonally frozen ground or in fossil form; any wedge-shaped mass whose origin involves cold or freezing conditions. In this survey area frost wedges consist of vertical, wedge-shaped inclusions in the soil mantle containing coarse, angular rock fragments and few fines.

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of present landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features.

Glacial cirque. Semicircular, concave, bowllike areas that have steep faces primarily resulting from past or present glacial ice and snow abrasion.

Glacial cirque headwall. The steep rock face above the cirque basin.

Glacial drift. Pulverized and other rock material transported by glacier ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial moraine. A mound, ridge, or other distinct accumulation of unsorted, nonstratified glacial drift, predominantly glacial till.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glacial trough walls. Steep sides of a U-shaped glacial valley. Typically refers to alpine glaciation.

Glacially scoured slopes. Slopes that have been abraded by glacial action leaving areas of exposed bedrock and thin deposits of till.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Hogback. Any ridge with a sharp summit and steep slopes of nearly equal inclination. The term is usually restricted to ridges carved from beds dipping at angles of more than 20 degrees.

Hummocky relief. A series of rounded or conical mounds causing an uneven, rolling appearance to the landscape.

Landslide. A mass-wasting process, and the landform produced, involving moderately rapid or rapid (more than 1 foot per year) downslope transport, by means of gravitational stresses, of a mass of rock and regolith.

Loose herding of sheep. The practice of distributing grazing sheep in a large area, rather than in a moving band.

Map unit. The set of areas delineated on a map considered similar to all other members of the set (delineations) with respect to the selected properties used to define the set.

Outsloped road. Graded toward the embankment to produce a downward slope across the road surface to the side of the road away from the roadcut.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Patterned ground. More or less symmetrical forms, such as circles, polygons, nets, stripes, garlands, and steps, that are characteristic of, but not confined to, mantles subjected to intense frost action as in periglacial environments. Stone polygons generally form on slopes of less than 8 percent, while garlands occur on slopes of 8 to 15 percent and stripes on slopes of more than 15 percent.

Pergelic soil temperature regime. A soil temperature regime in which the mean annual soil temperature at a depth of 50 centimeters is less than 0 degrees C.

Periglacial environment. Conditions occurring at the immediate margins of former and existing glaciers and ice sheets and influenced by the cold temperature of the ice.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or differences in elevation of a land surface, considered collectively.

Riparian. Bordering a lake or stream.

Rock glacier. A mass of poorly sorted, angular boulders and fine material cemented by interstitial ice a meter or so below the surface. A rock glacier has the general appearance and slow movement of a small valley glacier with a distal area (toe) marked by a series of transverse, arcuate, rounded ridges.

Rock outcrop. Barren exposures of hard bedrock that is fractured in places. Some soil material is in cracks and crevices. In this survey area the rock is mostly hard crystalline rock, rhyolite, volcanic rock, sandstone, or limestone. When rock outcrop is on steep slopes, it generally includes small areas of loose stones, cobbles, or gravel.

Rolling grade. A road drainage practice in which the road grade is designed to provide low points at intervals to allow drainage water to escape.

Scarp slope. A relatively steep slope facing in a direction opposite to the dip of the strata.

Scree. A sheet of coarse (fragmented) debris mantling a slope (see Talus).

Selection system. A silvicultural forest regeneration method where trees are removed periodically, individually or in small groups, from an uneven-aged forest in order to realize the yield and establish a new crop of uneven age distribution.

Shelterwood system. A silvicultural forest regeneration method where part of the residual forest stand is left on a site to provide a source of seed for a new even-aged stand.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, the classes for slopes are as follows:

Nearly level	0 to 10 percent
Gently sloping	10 to 20 percent
Moderately steep	20 to 45 percent
Steep	45 to 65 percent
Very steep	65 percent

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stream channel gradient. In this survey area, the classes for stream channel gradients are as follows:

Low	less than 5 percent
Moderate	5 to 10 percent
Steep	more than 10 percent

Stream dissection. The gully, ravine, or canyon that has been cut into an otherwise relatively uniform land surface by a stream.

Stream pattern. The different stream patterns in the survey area are:

Dendritic.—The streams branch irregularly in all directions and at almost any angle.

Deranged.—A distinctively disordered stream pattern that shows a complete lack of underlying bedrock or structural control. It is characterized by irregular streams that flow into and out of lakes, by a few short tributaries, and by swampy interstream areas.

Parallel.—The streams and their tributaries are regularly spaced and virtually parallel to one another.

Trellis.—Parallel main streams intersected at or near right angles by their tributaries which, in turn, are fed by elongated secondary tributaries parallel to the main streams.

Streams. The different kinds of streams in the survey area are:

Entrenched.—A stream that flows in a narrow gully or ravine cut into a slope or plain.

Intermittent.—A stream, or reach of a stream, that flows for protracted periods only when it receives ground water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Perennial.—A stream, or reach of a stream, that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the region adjoining the stream.

Poorly defined.—A stream having a poorly developed streambed and banks that are hard to define if water is not running in the stream. A poorly defined stream often is in dips or swales, and the channel may contain some gravel but only at its lowest point or center. Riparian vegetation is uncommon but may occur as clumps in low points of microrelief close to the stream.

Well defined.—A stream having a well developed streambed and a tendency to have near vertical banks along low gradient areas. Riparian vegetation often is on the banks, and the channel is well established and commonly has a gravel bottom.

Stream terrace. One of a series of platforms in a

stream valley, flanking and more or less parallel to the stream, and representing the dissected remnants of an abandoned flood plain, streambed, or valley floor produced during a former stage of erosion or deposition.

Structurally controlled slopes. The arrangement, disposition, and erosional characteristics of underlying rocks determine, to a significant degree, the shape of the terrain. Faulting and uplift of bedrock (especially limestone, shale, and sandstone) and subsequent erosion create a repeating pattern on the landscape, with weaker strata forming low areas and more erosion-resistant strata forming ridges and outcrops.

Talus. Rock fragments of any size or shape (generally coarse and angular) derived from and lying at the base of a cliff or very steep rock slope.

Taxonomic unit. A class in the soil taxonomic (classification) system used to define soils in a soil survey. A taxonomic unit may be defined at any categorical level in the soil classification system being used.

Udic soil moisture regime. A soil that, in the moisture-control section of the soil profile, is not dry (less than 15-bar soil water) in any part for as long as 90 days (cumulative) in most years and is not dry in all parts for as long as 45 consecutive days in the 4 months that follow the summer solstice in 6 or more years out of 10.

Ustic soil moisture regime. A soil that, in the moisture-control section of the soil profile, is dry (less than 15-bar soil water) in some or all parts for 90 days or more (cumulative) in most years but is not dry in all parts more than half the time the soil temperature is above 50 degrees C at a depth of 50 centimeters. This moisture regime is intended to recognize soils that are dry most of the time; however, moisture is available to plants during the growing season.

Undifferentiated group. A map unit made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform.

Water bar. A ridge made across a road surface to divert water.

Welded tuff. A pyroclastic rock that has been indurated by the combined action of the heat retained by particles, the weight of overlying material, and hot gasses.

Tables

TABLE 1.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS

(Absence of an entry indicates data were not estimated)

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
12-1A	Glaciated mountain ridges.	5-20	Granitic rocks	Upper subalpine forest	Variable	7,800-8,500	---
12-1C	Glaciated mountain ridges.	5-20	Granitic rocks	Lower subalpine forest	Variable	6,500-7,800	---
12-2A	Mountain ridges	5-20	Volcanic rocks	Lower subalpine forest	Variable	7,200-7,800	---
12-2B	Mountain ridges	5-20	Volcanic rocks	Upper subalpine forest	Variable	7,800-8,500	---
13-1A	Mountain ridges	10-45	Granitic rocks	Alpine meadows	Variable	9,000-9,800	20
13-2A	Mountain ridges	10-45	Volcanic rocks	Alpine meadows	Variable	9,000-9,800	---
22-1A	Glacial cirque headwalls and trough walls.	45-70	Granitic rocks	Lower subalpine forest	Variable	7,600-8,500	20
22-1B	Glacial cirque headwalls and trough walls.	45-70	Granitic rocks	Mountain grassland and open-grown forest.	Southern	5,800-7,600	30
22-1C	Glacial cirque headwalls and trough walls.	45-70	Grantic or volcanic rocks	Timberline forest and alpine meadows.	Variable	8,200-9,500	60
22-2A	Glacial cirque headwalls and trough walls.	45-70	Interbedded sandstone and shale.	Lower subalpine forest	Variable	7,600-8,500	20
22-3A	Glacial cirque headwalls and trough walls.	45-70	Volcanic rocks	Lower subalpine forest	Variable	7,600-8,500	20
22-3C	Glaciated mountain ridges.	5-20	Granitic rocks	Lower subalpine forest	Variable	8,200-8,600	20
25-1A	Glacial cirque basins	5-20	Granitic rocks	Alpine meadows	Variable	8,000-9,500	20
25-3A	Glacial cirque basins	5-20	Glacial drift, volcanic rocks, and interbedded sandstone and shale.	Timberline forest and alpine meadows.	Variable	8,000-9,500	25
34-1A	Moraines	5-20	Glacial drift	Upper subalpine forest	Variable	7,600-8,500	---
34-1B	Moraines	5-20	Glacial drift	Mountain shrubland	Southern	6,500-7,500	---

TABLE 1.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
34-1C--	Moraines-------------	5-20	Glacial drift------------	Lower subalpine forest	Northern	6,700-7,900	---
34-1D--	Moraines-------------	5-20	Glacial drift------------	Dense Douglas-fir and open-grown forests.	Variable	6,500-7,500	---
34-2C--	Moraines-------------	5-20	Glacial drift------------	Upper subalpine forest and mountain meadows.	Variable	8,000-8,500	---
34-2D--	Moraines-------------	5-20	Glacial drift------------	Lower subalpine forest and mountain meadows.	Variable	7,000-8,500	---
34-3A--	Moraines-------------	5-20	Glacial drift------------	Upper subalpine forest	Variable	7,800-8,500	---
34-3B--	Moraines-------------	5-20	Glacial drift------------	Lower subalpine forest	Variable	7,200-8,000	---
34-4B--	Moraines-------------	5-20	Glacial drift------------	Lower subalpine forest	Variable	7,000-7,800	0
34-4C--	Moraines-------------	5-20	Glacial drift------------	Mountain shrubland-----	Variable	6,800-7,800	0
35-1A--	Glaciated mountain slopes.	45-70	Glacial drift------------	Upper subalpine forest	Variable	7,800-8,500	15
35-1B--	Glaciated mountain slopes.	45-70	Glacial drift------------	Mountain shrubland-----	Variable	6,500-7,500	---
35-1C--	Glaciated mountain slopes.	45-70	Glacial drift------------	Lower subalpine forest	Variable	6,800-7,800	---
35-2C--	Glaciated mountain slopes.	45-70	Glacial drift------------	Lower subalpine forest and mountain meadows.	Variable	6,800-7,800	---
35-3A--	Glaciated mountain slopes.	45-70	Glaciated drift----------	Upper subalpine forest and mountain meadows.	Variable	7,800-8,500	15
35-3B--	Glaciated mountain slopes.	45-70	Glacial drift------------	Lower subalpine forest	Variable	7,200-8,000	---
35-4C--	Glaciated mountain slopes.	45-70	Glacial drift------------	Mountain shrubland-----	Variable	6,800-7,800	---
46-1B--	Terraces-------------	0-10	Glacial outwash and alluvial deposits.	Mountain shrubland-----	Variable	5,200-6,400	0
46-2A--	Terraces-------------	0-10	Glacial outwash and alluvial deposits.	Mountain grassland and shrubland.	Variable	6,500-7,500	0
46-3A--	Terraces-------------	0-10	Glacial outwash and alluvial deposits.	Dense lodgepole pine forest.	Variable	6,600-7,000	0
53-1A--	Mountain slopes------	10-45	Granitic rocks-----------	Mountain grassland and shrubland.	Variable	6,800-7,800	15

TABLE 1.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
53-1D	Mountain slopes	10-45	Grantic rocks	Lower subalpine forest	Variable	6,100-7,800	---
53-3A	Mountain slopes	10-45	Volcanic rocks	Mountain grassland and shrubland.	Variable	6,500-7,400	---
53-3B	Mountain slopes	10-45	Volcanic rocks	Lower subalpine and dense Douglas-fir forests.	Variable	6,500-7,800	---
53-3C	Mountain slopes	10-45	Volcanic rocks	Lower subalpine forest	Variable	6,500-7,800	---
54-1A	Mountain slopes	45-70	Granitic rocks	Mountain grassland and shrubland.	Variable	6,000-8,000	20
54-1B	Mountain slopes	45-70	Granitic rocks	Open-grown and lower subalpine forests.	Variable	6,500-8,000	40
54-1C	Mountain slopes	45-70	Granitic rocks	Dense and open-grown Douglas-fir forests.	Variable	6,500-7,500	15
54-1E	Mountain slopes	45-70	Granitic rocks	Upper subalpine forest	Variable	6,600-8,200	30
54-1G	Mountain slopes	45-70	Granitic rocks	Lower subalpine forest	Variable	5,600-8,000	15
54-2B	Mountain slopes	45-70	Limestone and sandstone	Open-grown forest and and mountain grassland and shrubland.	Variable	6,000-7,500	40
54-2C	Mountain slopes	45-70	Limestone	Lower subalpine forest	Variable	7,000-8,000	40
54-2D	Mountain slopes	45-70	Interbedded sandstone and shale.	Dense Douglas-fir forest and mountain grassland and shrubland.	Variable	6,500-7,500	15
54-2E	Mountain slopes	45-70	Interbedded sandstone and shale.	Lower subalpine forest	Variable	7,000-8,000	15
54-3A	Mountain slopes	45-70	Volcanic rocks	Mountain grassland and shrubland.	Variable	6,500-7,500	15
54-3C	Mountain slopes	45-70	Volcanic rocks	Dense Douglas-fir forest and mountain grassland and shrubland.	Southern	6,500-7,500	15
54-3D	Mountain slopes	45-70	Volcanic rocks	Lower subalpine and dense Douglas-fir forests.	Variable	6,500-7,800	---
54-3E	Mountain slopes	45-70	Volcanic rocks	Upper subalpine forest	Variable	7,800-8,500	---

TABLE 1.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
54-3F	Mountain slopes	45-70	Volcanic rocks	Upper and lower subalpine forests.	Variable	6,800-8,000	40
54-5A	Mountain slopes	45-70	Interbedded sandstone and shale.	Open-grown and dense Douglas-fir forests.	Variable	5,200-6,200	20
54-5C	Mountain slopes	45-70	Interbedded sandstone and shale.	Dense Douglas-fir and open-grown forests.	Variable	6,000-7,500	25
61-2A	Alluvial fans	10-20	Alluvial deposits	Mountain grassland and shrubland.	Variable	5,400-6,500	0
64-2A	Terraces and flood plains.	0-10	Glacial outwash deposits	Mountain grassland and shrubland.	Variable	6,500-8,000	0
64-2C	Terraces and flood plains.	0-10	Glacial outwash and alluvial deposits.	Lower subalpine forest	Variable	6,000-7,000	0
66-1A	Flood plains and terraces.	0-10	Alluvial deposits	Mountain meadows and riparian communities.	Variable	6,600-8,600	0
71-1A	Landslides	5-20	Landslide deposits	Lower subalpine forest	Variable	7,000-8,000	0
71-1B	Landslides	5-20	Landslide deposits	Mountain grassland and shrubland and lower subalpine forest.	Variable	6,800-7,800	0
71-1C	Landslides	5-20	Landslide deposits	Upper subalpine forest	Variable	7,800-8,600	0
71-1D	Landslides	5-20	Landslide deposits	Lower subalpine forest	Variable	7,000-8,000	0
71-1E	Landslides	5-20	Landslide deposits	Dense Douglas-fir and lower subalpine forests.	Southern	6,700-7,500	0
71-2A	Landslides	5-20	Landslide deposits	Lower subalpine forest	Variable	7,000-8,000	0
71-2B	Landslides	5-20	Landslide deposits	Lower subalpine forest	Variable	7,000-8,200	0
71-2C	Landslides	5-20	Landslide deposits	Upper and lower subalpine forests.	Variable	7,800-8,500	0
71-2D	Landslides	5-20	Landslide deposits	Mountain grassland and shrubland and dense Douglas-fir forest.	Southern	6,800-7,800	0
82-2B	Structurally controlled slopes.	10-20	Interbedded sandstone and shale.	Lower subalpine forest	Northern	7,000-8,000	---
82-2C	Structurally controlled slopes.	10-20	Interbedded sandstone and shale.	Upper and lower subalpine forests.	Northern	8,000-8,800	---

TABLE 1.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
84-1A	Structurally controlled slopes.	10-45	Interbedded sandstone and shale.	Dense Douglas-fir or lodgepole pine forest.	Northern	6,500-7,200	---
84-1B	Structually controlled slopes.	10-45	Interbedded sandstone and shale.	Mountain grassland and shrubland.	Southern	6,000-7,000	---
84-2B	Structurally controlled slopes.	10-20	Interbedded sandstone and shale.	Lower subalpine forest and mountain grassland.	Variable	6,400-7,000	---
85-2A	Structurally controlled slopes.	45-70	Limestone	Open-grown and dense Douglas-fir forests.	Variable	6,800-8,200	25
85-2B	Structurally controlled slopes.	45-70	Limestone and shale	Lower subalpine and dense Douglas-fir forests.	Variable	6,000-7,500	15
85-3A	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Dense Douglas-fir forest and mountain grassland and shrubland.	Variable	6,300-7,200	20
85-3B	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Lower subalpine and dense Douglas-fir forests.	Variable	6,600-7,800	---
86-2A	Structurally controlled slopes.	10-45	Interbedded sandstone and shale.	Lower subalpine forest and mountain meadows.	Variable	6,800-8,000	---
86-2C	Structurally controlled slopes.	10-45	Interbedded sandstone and shale.	Mountain grassland and shrubland.	Variable	7,000-8,000	---
86-2D	Structurally controlled slopes.	10-45	Interbedded sandstone and shale.	Upper and lower subalpine forests.	Variable	6,800-7,800	---
86-2E	Structurally controlled slopes.	10-30	Interbedded sandstone and shale.	Upper subalpine forest and mountain meadows.	Variable	7,000-8,000	---
86-3B	Structurally controlled slopes.	10-30	Interbedded sandstone and shale.	Lower subalpine and dense Douglas-fir forests.	Variable	5,500-7,000	---
86-3C	Structurally controlled slopes.	10-45	Interbedded sandstone and shale.	Mountain grassland and shrubland.	Variable	5,500-7,000	---
87-1A	Structurally controlled slopes.	45-70	Limestone and sandstone	Timberline forest and alpine meadows.	Variable	7,800-8,800	50
87-1B	Structurally controlled slopes.	45-70	Limestone	Mountain grassland and shrubland.	Southern	5,800-7,800	15

TABLE 1.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
87-1D--	Structurally controlled slopes.	45-70	Limestone----------------	Lower subalpine forest	Variable	6,700-7,500	20
87-2A--	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Mountain grassland and open-grown forest.	Southern	5,800-7,800	---
87-2B--	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Lower subalpine and dense Douglas-fir forests.	Northern	6,500-7,500	15
87-2C--	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Mountain grassland and shrubland and dense Douglas-fir forest.	Southern	6,500-7,500	---
87-2D--	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Lower subalpine forest	Northern	6,500-8,000	---
87-2E--	Structurally controlled slopes.	45-70	Interbedded sandstone and shale.	Upper subalpine forest and alpine meadows.	Variable	8,000-8,800	20
88-1A--	Lava flows-----------	5-20	Rhyolite, welded tuff, and obsidian.	Lower subalpine forest	Northern	7,200-7,800	---
88-2A--	Lava flows-----------	5-20	Rhyolite, welded tuff, and obsidian.	Lower subalpine forest	Variable	6,800-7,500	0
91-2B--	Colluvial fans-------	10-45	Colluvial deposits--------	Lower subalpine forest and mountain meadows.	Variable	7,800-8,500	---
93-1A--	Talus slopes---------	20-45	---	---	Variable	7,000-9,800	90

TABLE 2.--NUMERICAL LISTING OF MAP SYMBOLS AND THE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
12-1A	Dystric Cryochrepts, glaciated mountain ridges	17,452	1.2
12-1C	Typic Cryochrepts, glaciated mountain ridges	7,558	0.5
12-2A	Mollic Cryoboralfs, volcanic substratum	8,276	0.5
12-2B	Mollic Cryoboralfs, volcanic substratum, cold	6,947	0.5
13-1A	Dystric Cryochrepts-Rock outcrop complex, alpine meadows	12,481	0.8
13-2A	Typic Cryochrepts-Argic Cryoborolls association, cold	4,900	0.3
22-1A	Dystric Cryochrepts-Rock outcrop complex, granitic substratum	23,479	1.6
22-1B	Typic Ustochrepts-Rock outcrop-Typic Haploborolls complex, cirque headwalls	13,490	0.9
22-1C	Rock outcrop-Typic Cryochrepts complex, cirque headwalls	65,859	4.5
22-2A	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, cirque headwalls	5,996	0.4
22-3A	Typic Cryochrepts-Rock outcrop complex, volcanic substratum	20,240	1.3
22-3C	Typic Cryochrepts-Rock outcrop-Cryaquolls complex, glaciated mountain ridges	6,968	0.4
25-1A	Dystric Cryochrepts-Rock outcrop complex, cirque basins	12,853	0.8
25-3A	Argic Cryoborolls-Typic Cryoboralfs-Rock outcrop complex, cirque basins	22,526	1.5
34-1A	Dystic Cryochrepts, glacial drift substratum	10,584	0.7
34-1B	Argic Cryoborolls and Typic Cryoborolls, glacial drift substratum	8,427	0.6
34-1C	Typic Cryochrepts, glacial drift substratum	39,280	2.7
34-1D	Typic Cryochrepts-Typic Cryoborolls complex, glacial drift substratum	5,616	0.4
34-2C	Mollic Cryoboralfs-Argic Cryoborolls association, cold	8,928	0.6
34-2D	Typic Cryoboralfs-Argic Cryoborolls association, moraines	17,534	1.2
34-3A	Mollic Cryoboralfs, glacial drift substratum, cold	9,514	0.6
34-3B	Mollic Cryoboralfs, glacial drift substratum	18,141	1.2
34-4B	Typic Cryoboralfs, glacial drift substratum	4,356	0.3
34-4C	Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum	10,236	0.7
35-1A	Dystric Cryochrepts-Rock outcrop complex, cold, steep	15,089	1.0
35-1B	Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum, steep	7,034	0.5
35-1C	Typic Cryochrepts, glacial drift substratum, steep	21,193	1.4
35-2C	Mollic Cryoboralfs-Argic Cryoborolls association, steep	10,568	0.7
35-3A	Mollic Cryoboralfs-Rock outcrop complex, cold	9,796	0.6
35-3B	Mollic Cryoboralfs, glacial drift substratum, steep	13,012	0.9
35-4C	Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum, moist, steep	3,413	0.2
46-1B	Typic Argiborolls and Aridic Argiborolls, moderately coarse textured substratum	9,707	0.6
46-2A	Typic Argiborolls and Aridic Argiborolls, medium and moderately fine textured substratum	13,676	0.9
46-3A	Typic Cryochrepts, obsidian sand substratum	30,442	2.1
53-1A	Typic Cryoborolls-Argic Cryoborolls-Rock outcrop association, south aspect	8,123	0.5
53-1D	Typic Cryochrepts, mountain slopes	9,225	0.6
53-3A	Argic Cryoborolls-Argic Pachic Cryoborolls association, mountain slopes	7,787	0.5
53-3B	Mollic Cryoboralfs-Argic Cryoborolls association, mountain slopes	4,893	0.3
53-3C	Mollic Cryoboralfs, mountain slopes	6,806	0.4
54-1A	Typic Haploborolls-Typic Ustochrepts-Rock outcrop complex, mountain slopes, steep	23,511	1.6
54-1B	Rock outcrop-Typic Cryochrepts-Typic Cryoborolls complex, south aspect, steep	35,686	2.5
54-1C	Typic Cryochrepts-Rock outcrop complex, warm, steep	18,260	1.5
54-1E	Dystric Cryochrepts-Rock outcrop complex, steep	24,082	1.6
54-1G	Typic Cryochrepts-Rock outcrop complex, steep	52,758	3.6
54-2B	Rock outcrop-Typic Ustochrepts-Typic Calciborolls complex, steep	9,650	0.6

TABLE 2.--NUMERICAL LISTING OF MAP SYMBOLS AND THE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
54-2C	Typic Cryochrepts-Rock outcrop complex, limestone substratum, steep	15,968	1.1
54-2D	Typic Argiborolls-Typic Ustochrepts-Rock outcrop complex, steep	4,409	0.3
54-2E	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, mountain slopes	3,036	0.2
54-3A	Typic Argiborolls-Pachic Argiborolls-Rock outcrop complex, south aspect, steep	6,210	1.1
54-3C	Mollic Eutroboralfs-Typic Argiborolls-Rock outcrop complex, steep	23,124	1.5
54-3D	Mollic Cryoboralfs, mountain slopes, steep	28,439	1.9
54-3E	Mollic Cryoboralfs, mountain slopes, cold, steep	2,448	0.2
54-3F	Rock outcrop-Argic Cryoborolls-Mollic Cryoboralfs complex, steep	28,667	1.9
54-5A	Typic Argiborolls-Mollic Eutroboralfs-Rock outcrop association, steep	9,942	0.7
54-5C	Typic Cryoboralfs-Mollic Cryoboralfs-Rock outcrop complex, steep	23,121	1.5
61-2A	Typic Argiborolls and Typic Calciborolls, alluvial fans	5,370	0.4
64-2A	Typic Cryoborolls and Argic Cryoborolls, terraces and flood plains	16,344	1.1
64-2C	Typic Cryoboralfs and Argic Cryoborolls, terraces and flood plains	16,165	1.1
66-1A	Cryaquolls and Cryaquents, flood plains	13,138	0.9
71-1A	Aquic Cryoboralfs-Typic Cryoboralfs complex, landslides	31,386	2.2
71-1B	Argic Cryoborolls-Argic Pachic Cryoborolls complex, landslides	7,278	0.5
71-1C	Typic Cryoboralfs-Aquic Cryoboralfs complex, landslides, cold	14,771	1.0
71-1D	Typic Cryoboralfs-Typic Cryochrepts complex, landslides	12,293	0.8
71-1E	Mollic Cryoboralfs-Argic Cryoborolls complex, landslides	6,634	0.4
71-2A	Typic Cryoboralfs-Aquic Cryoboralfs complex, landslides	13,180	0.9
71-2B	Typic Cryoboralfs, landslides, cool	14,541	1.0
71-2C	Mollic Cryoboralfs-Argic Cryoborolls complex, landslides, cold	10,546	0.7
71-2D	Argic Cryoborolls-Mollic Cryoboralfs complex, landslides, volcanic substratum	5,415	0.4
82-2B	Typic Cryoboralfs, structurally controlled slopes	10,787	0.7
82-2C	Typic Cryoboralfs-Aquic Cryoboralfs complex, structurally controlled slopes	10,498	0.7
84-1A	Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes, northerly aspects	10,289	0.7
84-1B	Typic Argiborolls, structurally controlled slopes	7,242	0.5
84-2B	Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes	16,772	1.1
85-2A	Typic Calciborolls-Rock outcrop-Typic Ustochrepts complex, limestone substratum, steep	17,813	1.2
85-2B	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, calcareous substratum	11,152	0.7
85-3A	Mollic Cryoboralfs-Argic Cryoborolls-Rock outcrop complex, structurally controlled slopes, steep	39,772	2.7
85-3B	Mollic Cryoboralfs-Argic Cryoborolls complex, structurally controlled slopes, steep	24,920	1.6
86-2A	Typic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes	13,548	0.9
86-2C	Argic Cryoborolls, structurally controlled slopes	17,258	1.1
86-2D	Typic Cryoboralfs-Mollic Cryoboralfs complex, structurally controlled slopes	18,726	1.2
86-2E	Argic Cryoborolls-Mollic Cryoboralfs complex, structurally controlled slopes	11,368	0.8
86-3B	Typic Cryoboralfs-Mollic Cryoboralfs complex, structurally controlled slopes, warm	23,848	1.6

TABLE 2.--NUMERICAL LISTING OF MAP SYMBOLS AND THE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
86-3C	Argic Cryoborolls-Typic Cryoborolls association, structurally controlled slopes	18,451	1.2
87-1A	Rock outcrop-Typic Cryochrepts-Typic Cryoborolls complex, limestone substratum	51,437	3.4
87-1B	Typic Calciborolls-Typic Argiborolls-Rock outcrop complex, steep	5,342	0.4
87-1D	Typic Cryochrepts-Typic Cryoboralfs-Rock outcrop complex, structurally controlled slopes	19,501	1.3
87-2A	Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes, steep	16,319	1.1
87-2B	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, structurally controlled slopes	11,488	0.8
87-2C	Argic Cryoborolls complex, structurally controlled slopes, steep	9,791	0.6
87-2D	Mollic Cryoboralfs-Typic Cryoboralfs complex, steep	14,299	0.9
87-2E	Mollic Cryoboralfs-Argic Cryoborolls-Rock outcrop complex, structurally controlled slopes, cold	13,184	0.9
88-1A	Typic Cryochrepts, rhyolite flows	17,330	1.1
88-2A	Typic Cryoboralfs-Typic Cryochrepts complex, rhyolite flows	12,059	0.8
91-2B	Mollic Cryoboralfs-Argic Cryoborolls complex, colluvial substratum	26,217	0.4
93-1A	Rubble land	45,880	3.0
	Total	1,504,068	100.0

TABLE 3.--ALPHABETICAL LISTING OF DETAILED SOIL MAP UNITS

Map symbol	Soil name
71-1A	Aquic Cryoboralfs-Typic Cryoboralfs complex, landslides
34-1B	Argic Cryoborolls and Typic Cryoborolls, glacial drift substratum
87-2C	Argic Cryoborolls complex, structurally controlled slopes, steep
86-2C	Argic Cryoborolls, structurally controlled slopes
53-3A	Argic Cryoborolls-Argic Pachic Cryoborolls association, mountain slopes
34-4C	Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum
35-1B	Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum, steep
35-4C	Argic Cryoborolls-Argic Pachic Cryoborolls complex, glacial drift substratum, moist, steep
71-1B	Argic Cryoborolls-Argic Pachic Cryoborolls complex, landslides
86-2E	Argic Cryoborolls-Mollic Cryoboralfs complex, structurally controlled slopes
71-2D	Argic Cryoborolls-Mollic Cryoboralfs complex, landslides, volcanic substratum
25-3A	Argic Cryoborolls-Typic Cryoboralfs-Rocks outcrop complex, cirque basins
86-3C	Argic Cryoborolls-Typic Cryoborolls association, structurally controlled slopes
66-1A	Cryaquolls and Cryaquents, flood plains
34-1A	Dystric Cryochrepts, glacial drift substratum
12-1A	Dystric Cryochrepts, glaciated mountain ridges
13-1A	Dystric Cryochrepts-Rock outcrop complex, alpine meadows
25-1A	Dystric Cryochrepts-Rock outcrop complex, cirque basins
35-1A	Dystric Cryochepts-Rock outcrop complex, cold, steep
22-1A	Dystric Cryochrepts-Rock outcrop complex, granitic substratum
54-1E	Dystric Cryochrepts-Rock outcrop complex, steep
34-3B	Mollic Cryoboralfs, glacial drift substratum
34-3A	Mollic Cryoboralfs, glacial drift substratum, cold
35-3B	Mollic Cryoboralfs, glacial drift substratum, steep
53-3C	Mollic Cryoboralfs, mountain slopes
54-3E	Mollic Cryoboralfs, mountain slopes, cold, steep
54-3D	Mollic Cryoboralfs, mountain slopes, steep
12-2A	Mollic Cryoboralfs, volcanic substratum
12-2B	Mollic Cryoboralfs, volcanic substratum, cold
87-2A	Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes, steep
34-2C	Mollic Cryoboralfs-Argic Cryoborolls association, cold
53-3B	Mollic Cryoboralfs-Argic Cryoborolls association, mountain slopes
35-2C	Mollic Cryoboralfs-Argic Cryoborolls association, steep
84-1A	Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes, northerly aspects
84-2B	Mollic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes
91-2B	Mollic Cryoboralfs-Argic Cryoborolls complex, colluvial substratum
71-1E	Mollic Cryoboralfs-Argic Cryoborolls complex, landslides
71-2C	Mollic Cryoboralfs-Argic Cryoborolls complex, landslides, cold
85-3B	Mollic Cryoboralfs-Argic Cryoborolls complex, structurally controlled slopes, steep
85-3A	Mollic Cryoboralfs-Argic Cryoborolls-Rock outcrop complex, structurally controlled slopes, steep
87-2E	Mollic Cryoboralfs-Argic Cryoborolls-Rock outcrop complex, structurally controlled slopes, cold
35-3A	Mollic Cryoboralfs-Rock outcrop complex, cold
87-2D	Mollic Cryoboralfs-Typic Cryoboralfs complex, steep
54-3C	Mollic Eutroboralfs-Typic Argiborolls-Rock outcrop complex, steep
54-3F	Rock outcrop-Argic Cryoborolls-Mollic Cryoboralfs complex, steep
22-1C	Rock outcrop-Typic Cryochrepts complex, cirque headwalls
87-1A	Rock outcrop-Typic Cryochrepts-Typic Cryoborolls complex, limestone substratum
54-1B	Rock outcrop-Typic Cryochrepts-Typic Cryoborolls complex, south aspect, steep

TABLE 3.--ALPHABETICAL LISTING OF DETAILED SOIL MAP UNITS--Continued

Map symbol	Soil name
54-2B	Rock outcrop-Typic Ustochrepts-Typic Calciborolls complex, steep
93-1A	Rubble land
46-2A	Typic Argiborolls and Aridic Argiborolls, medium and moderately fine textured substratum
46-1B	Typic Argiborolls and Aridic Argiborolls, moderately coarse textured substratum
61-2A	Typic Argiborolls and Typic Calciborolls, alluvial fans
84-1B	Typic Argiborolls, structurally controlled slopes
54-5A	Typic Argiborolls-Mollic Eutroboralfs-Rock outcrop association, steep
54-3A	Typic Argiborolls-Pachic Argiborolls-Rock outcrop complex, south aspect, steep
54-2D	Typic Argiborolls-Typic Ustochrepts-Rock outcrop complex, steep
85-2A	Typic Calciborolls-Rock outcrop-Typic Ustochrepts complex, limestone substratum, steep
87-1B	Typic Calciborolls-Typic Argiborolls-Rock outcrop complex, steep
64-2C	Typic Cryoboralfs and Argic Cryoborolls, terraces and flood plains
82-2B	Typic Cryoboralfs, structurally controlled slopes
34-4B	Typic Cryoboralfs, glacial drift substratum
71-2B	Typic Cryoboralfs, landslides, cool
82-2C	Typic Cryoboralfs-Aquic Cryoboralfs complex, structurally controlled slopes
71-2A	Typic Cryoboralfs-Aquic Cryoboralfs complex, landslides
71-1C	Typic Cryoboralfs-Aquic Cryoboralfs complex, landslides, cold
34-2D	Typic Cryoboralfs-Argic Cryoborolls association, moraines
86-2A	Typic Cryoboralfs-Argic Cryoborolls association, structurally controlled slopes
86-2D	Typic Cryoboralfs-Mollic Cryoboralfs complex, structurally controlled slopes
86-3B	Typic Cryoboralfs-Mollic Cryoboralfs complex, structurally controlled slopes, warm
54-5C	Typic Cryoboralfs-Mollic Cryoboralfs-Rock outcrop complex, steep
71-1D	Typic Cryoboralfs-Typic Cryochrepts complex, landslides
88-2A	Typic Cryoboralfs-Typic Cryochrepts complex, rhyolite flows
85-2B	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, calcareous substratum
22-2A	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, cirque headwalls
54-2E	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, mountain slopes
87-2B	Typic Cryoboralfs-Typic Cryochrepts-Rock outcrop complex, structurally controlled slopes
64-2A	Typic Cryoborolls and Argic Cryoborolls, terraces and flood plains
53-1A	Typic Cryoborolls-Argic Cryoborolls-Rock outcrop association, south aspect
12-1C	Typic Cryochrepts, glaciated mountain ridges
34-1C	Typic Cryochrepts, glacial drift substratum
35-1C	Typic Cryochrepts, glacial drift substratum, steep
53-1D	Typic Cryochrepts, mountain slopes
46-3A	Typic Cryochrepts, obsidian sand substratum
88-1A	Typic Cryochrepts, rhyolite flows
13-2A	Typic Cryochrepts-Argic Cryoborolls association, cold
22-3C	Typic Cryochrepts-Rock outcrop-Cryaquolls complex, glaciated mountain ridges
54-2C	Typic Cryochrepts-Rock outcrop complex, limestone substratum, steep
54-1G	Typic Cryochrepts-Rock outcrop complex, steep
22-3A	Typic Cryochrepts-Rock outcrop complex, volcanic substratum
54-1C	Typic Cryochrepts-Rock outcrop complex, warm, steep
87-1D	Typic Cryochrepts-Typic Cryoboralfs-Rock outcrop complex, structurally controlled slopes
34-1D	Typic Cryochrepts-Typic Cryoborolls complex, glacial drift substratum

TABLE 3.--ALPHABETICAL LISTING OF DETAILED SOIL MAP UNITS--Continued

Map symbol	Soil name
54-1A	Typic Haploborolls-Typic Ustochrepts-Rock outcrop complex, mountain slopes, steep
22-1B	Typic Ustochrepts-Rock outcrop-Typic Haploborolls complex, cirque headwalls

TABLE 4.--TIMBER PRODUCTIVITY AND MANAGEMENT

(Only map units with a forested component are listed. The symbol ± means plus or minus; < means less than)

Map symbol	Forest vegetative group	Potential annual production	Non-forested area	Regeneration	Tractor operation	Sediment hazard
		cu ft/acre	Pct			
12-1A	Upper subalpine forest	24±8	10	Harsh climate	No limitations	Slight.
12-1C	Lower subalpine forest	43±10	5	Competition	No limitations	Slight.
12-2A	Lower subalpine forest	62±9	5	No limitations	No limitations	Slight.
12-2B	Upper subalpine forest	24±8	10	Harsh climate	No limitations	Slight.
22-1A	Lower subalpine forest	34±19	20	Moisture stress	Slope	Slight.
22-1B	Open-grown forest	21±5	50	Competition	Slope	Moderate.
22-2A	Lower subalpine forest	62±9	35	No limitations	Slope	Severe.
22-3A	Lower subalpine forest	43±10	30	No limitations	Slope, rock outcrop.	Moderate.
22-3C	Lower subalpine forest	62±9	30	No limitations	Wetness	Slight.
25-3A	Timberline forest	<20	70	Harsh climate	Rock outcrop	Slight.
34-1A	Upper subalpine forest	24±8	10	Harsh climate	No limitations	Slight.
34-1C	Lower subalpine forest	62±9	10	No limitations	No limitations	Slight.
34-1D	Dense Douglas-fir forest	33±18	10	Competition	No limitations	Slight.
	Open-grown forest	21±9		Competition	No limitations	Slight.
34-2C	Upper subalpine forest	41±9	40	Harsh climate	No limitations	Slight.
34-2D	Lower subalpine forest	58±13	40	Competition	No limitations	Slight.
34-3A	Upper subalpine forest	33±17	15	Harsh climate	No limitations	Slight.
34-3B	Lower subalpine forest	62±9	10	No limitations	No limitations	Slight.
34-4B	Lower subalpine forest	62±9	10	No limitations	No limitations	Slight.
35-1A	Upper subalpine forest	24±8	15	Harsh climate	Slope	Slight.
35-1C	Lower subalpine forest	48±15	10	Moisture stress	Slope	Moderate.
35-2C	Lower subalpine forest	62±5	25	No limitations	Slope	Moderate.
35-3A	Upper subalpine forest	33±17	30	Harsh climate	Slope	Moderate.
35-3B	Lower subalpine forest	65±16	10	No limitations	Slope	Moderate.
46-3A	Dense lodgepole pine forest	34±11	10	Moisture stress	Soil damage	Slight.
53-1D	Lower subalpine forest	61±8	5	No limitations	No limitations	Moderate.
53-3B	Lower subalpine forest	72±18	5	No limitations	No limitations	Moderate.
	Dense Douglas-fir forest	27±14		Moisture stress, competition.	No limitations	Moderate.
53-3C	Lower subalpine forest	62±9	5	No limitations	No limitations	Moderate.

TABLE 4.--TIMBER PRODUCTIVITY AND MANAGEMENT--Continued

Map symbol	Forest vegetative group	Potential annual production	Non-forested area	Regeneration	Tractor operation	Sediment hazard
		cu ft/acre	Pct			
54-1B	Lower subalpine forest	34±18	45	Competition	Rock outcrop	Moderate.
	Open-grown forest	21±5		Competition	Rock outcrop	Moderate.
54-1C	Dense Douglas-fir forest	42±6	15	No limitations	Slope	Moderate.
	Open-grown forest	21±5		Competition	Slope	Moderate.
54-1E	Upper subalpine forest	24±8	35	Harsh climate	Slope, rock outcrop.	Slight.
54-1G	Lower subalpine forest	69±16	15	No limitations	Slope	Moderate.
54-2B	Open-grown forest	32±16	65	Competition	Slope, rock outcrop.	Moderate.
54-2C	Lower subalpine forest	48±15	40	Moisture stress	Slope, rock outcrop.	Moderate.
54-2D	Dense Douglas-fir forest	32±16	60	Competition	Slope	Severe.
54-2E	Lower subalpine forest	61±9	20	No limitations	Slope	Severe.
54-3C	Dense Douglas-fir forest	32±16	35	Competition	Slope	Moderate.
54-3D	Lower subalpine forest	62±8	10	No limitations	Slope	Moderate.
	Dense Douglas-fir forest	64±11		No limitations	Slope	Moderate.
54-3E	Upper subalpine forest	24±8	10	Harsh climate	Slope	Moderate.
54-3F	Lower subalpine forest	51±14	50	Competition	Slope	Moderate.
	Upper subalpine forest	24±8		Harsh climate	Rock outcrop	Moderate.
54-5A	Dense Douglas-fir forest	51±9	35	Competition	Slope	Moderate.
	Open-grown forest	21±5		Competition	Slope	Moderate.
54-5C	Dense Douglas-fir forest	51±9	25	Competition	Slope	Moderate.
	Open-grown forest	21±5		Competition	Rock outcrop	Moderate.
64-2C	Lower subalpine forest	81±16	10	No limitations	No limitations	Moderate.
71-1A	Lower subalpine forest	71±19	15	No limitations	Wetness	Severe.
71-1B	Lower subalpine forest	60±8	65	No limitations	No limitations	Moderate.
71-1C	Upper subalpine forest	41±9	15	Harsh climate	Wet areas	Severe.
71-1D	Lower subalpine forest	62±9	10	Competition	No limitations	Moderate.
71-1E	Dense Douglas-fir forest	65±11	15	Competition	No limitations	Moderate.
	Lower subalpine forest	60±8		No limitations	No limitations	Moderate.
71-2A	Lower subalpine forest	76±10	5	No limitations	Wet areas	Severe.
71-2B	Lower subalpine forest	62±9	10	No limitations	No limitations	Moderate.
71-2C	Upper subalpine forest	41±9	15	Harsh climate	No limitations	Moderate.
	Lower subalpine forest	62±9		No limitations	No limitations	Moderate.

TABLE 4.--TIMBER PRODUCTIVITY AND MANAGEMENT--Continued

Map symbol	Forest vegetative group	Potential annual production	Non-forested area	Regeneration	Tractor operation	Sediment hazard
		cu ft/acre	Pct			
71-2D----	Dense Douglas-fir forest-----	61±14	60	Competition------	No limitations---	Moderate.
82-2B----	Lower subalpine forest-------	61±9	10	No limitations---	No limitations---	Moderate.
82-2C----	Upper subalpine forest-------	41±9	15	Harsh climate----	No limitations---	Moderate.
	Lower subalpine forest-------	49±9		No limitations---	No limitations---	Moderate.
84-1A----	Dense Douglas-fir forest-----	56±9	20	No limitations---	No limitations---	Moderate.
84-2B----	Lower subalpine forest-------	61±8	25	No limitations---	No limitations---	Slight.
85-2A----	Open-grown forest------------	21±5	25	Moisture stress, competition.	Slope------------	Moderate.
	Dense Douglas-fir forest-----	43±7		Moisture stress	Slope------------	Moderate.
85-2B----	Lower subapline forest-------	43±9	25	Moisture stress	Slope------------	Moderate.
	Dense Douglas-fir forest-----	43±7		Moisture stress	Slope------------	Moderate.
85-3A----	Dense Douglas-fir forest-----	45±19	50	Moisture stress, competition.	Slope------------	Moderate.
85-3B----	Lower subalpine forest-------	61±8	20	Competition------	Slope------------	Moderate.
	Dense Douglas-fir forest-----	45±19		Moisture stress, competition.	Slope------------	Moderate.
86-2A----	Lower subalpine forest-------	61±8	35	No limitations---	No limitations---	Moderate.
86-2D----	Lower subalpine forest-------	62±9	15	No limitations---	No limitations---	Moderate.
	Upper subalpine forest-------	<20		Harsh climate----	No limitations---	Moderate.
86-2E----	Upper subalpine forest-------	<20	65	Harsh climate----	No limitations---	Moderate.
86-3B----	Lower subalpine forest-------	61±8	15	No limitations---	No limitations---	Slight.
	Dense Douglas-fir forest-----	56±8		No limitations---	No limitations---	Slight.
87-1A----	Timberline forest------------	<20	60	Harsh climate----	Slope, rock outcrop.	Moderate.
87-1D----	Lower subalpine forest-------	46±6	25	Moisture stress, competition.	Slope------------	Moderate.
87-2A----	Open-grown forest------------	21±5	30	Competition------	Slope------------	Severe.
87-2B----	Dense Douglas-fir forest-----	56±8	20	No limitations---	Slope------------	Severe.
	Lower subalpine forest-------	62±9		No limitations---	Slope------------	Severe.
87-2C----	Dense Douglas-fir forest-----	42±6	70	Moisture stress, competition.	Slope------------	Severe.
87-2D----	Lower subalpine forest-------	66±14	10	No limitations---	Slope------------	Severe.
87-2E----	Upper subalpine forest-------	<20	40	Harsh climate----	Slope------------	Severe.
88-1A----	Lower subalpine forest-------	43±10	5	Competition------	No limitations---	Slight.
88-2A----	Lower subalpine forest-------	43+10	0	Competition------	No limitations---	Slight.
91-2B----	Lower subalpine forest-------	61±8	25	No limitations---	No limitations---	Moderate.

TABLE 5.--ENGINEERING INDEX PROPERTIES

(Absence of an entry indicates that data were not estimated)

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number-- 4	10	200	Liquid limit	Plasticity index
			Pct				Pct	
12-1A	Very cobbly loam	SM	30-50	60-75	45-60	20-45	7-15	NP-4
12-1C	Extremely cobbly sandy loam.	GM, SM	50-75	40-60	20-40	12-30	---	NP
12-2A	Very stony loam	SM	30-50	60-75	45-60	20-45	15-40	3-15
12-2B	Very stony loam	SM	30-50	60-75	45-60	20-45	15-40	3-15
13-1A	Very cobbly loamy sand	SM, SW-SM	30-50	60-75	45-60	5-15	---	NP
13-2A	Extremely cobbly sandy loam, gravelly clay loam.	GM, CL, SM	5-75	40-85	20-65	12-55	7-40	NP-20
22-1A	Very cobbly loamy sand	SM, SW-SM	30-50	60-75	45-60	5-15	---	NP
22-1B	Very gravelly sandy loam, very stony sandy loam.	GM, SM	10-50	30-75	25-60	12-30	---	NP
22-1C	Very cobbly sandy loam	SM	30-50	60-75	45-60	12-30	---	NP
22-2A	Gravelly loam, extremely cobbly sandy loam.	GM, ML, SM	5-75	40-85	20-65	12-55	7-40	NP-20
22-3A	Very cobbly loam	SM	30-50	60-75	45-60	20-45	7-15	NP-4
22-3C	Extremely cobbly sandy loam.	GM, SM	50-75	40-60	20-40	12-30	---	NP
25-1A	Extremely cobbly sandy loam.	GM, SM	50-75	40-60	20-40	12-30	---	NP
25-3A	Gravelly clay loam, gravelly loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
34-1A	Very cobbly sandy loam	SM	30-50	60-75	45-60	12-30	---	NP
34-1B	Very cobbly sandy loam	SM	30-50	60-75	45-60	12-30	---	NP
34-1C	Very cobbly sandy loam	SM	30-50	60-75	45-60	12-30	---	NP
34-1D	Very cobbly sandy loam	SM	30-50	60-75	45-60	12-30	---	NP
34-2C	Clay loam, gravelly clay loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
34-2D	Gravelly loam, very cobbly loam.	SC, CL	15-40	60-85	45-65	20-55	15-40	3-20
34-3A	Very stony loam	SM	30-50	60-75	45-60	20-45	15-40	3-20
34-3B	Very stony loam	SM	30-50	60-75	45-60	20-45	15-40	3-20
34-4B	Very stony loam	SM	30-50	60-75	45-60	20-45	15-40	3-20
34-4C	Gravelly clay loam, clay loam, loam.	SC, CL, SM	5-10	75-85	55-65	20-55	15-40	3-20

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number--			Liquid limit	Plasticity index
				4	10	200		
			Pct				Pct	
35-1A----	Very cobbly loam----------	SM	30-50	60-75	45-60	20-45	7-15	NP-4
35-1B----	Very cobbly sandy loam, very stony sandy loam.	SM	30-50	60-75	45-60	12-30	---	NP
35-1C----	Very cobbly sandy loam----	SM	30-50	60-75	45-60	20-45	---	NP
35-2C----	Gravelly clay loam--------	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
35-3A----	Very stony loam-----------	SM	30-50	60-75	45-60	20-45	15-40	3-20
35-3B----	Very stony loam-----------	SM	30-50	60-75	45-60	30-45	15-40	3-20
35-4C----	Gravelly clay loam, loam--	SC, CL, SM	5-10	75-85	55-65	20-55	15-40	3-20
46-1B----	Very cobbly sandy loam, very gravelly sandy loam.	GM, SM	10-50	30-75	25-60	12-30	---	NP
46-2A----	Very cobbly silt loam, very gravelly loam.	GM, SM	10-50	30-75	25-60	20-45	15-40	3-20
46-3A----	Very gravelly loamy coarse sand, very gravelly coarse sand.	GM, SP	10-15	30-50	25-40	0-15	---	NP
53-1A----	Very cobbly sandy loam----	SM	30-50	60-75	45-60	12-30	---	NP
53-1D----	Extremely cobbly sandy loam.	GM, SM	50-75	40-60	20-40	12-30	---	NP
53-3A----	Very cobbly loam, very cobbly silty clay loam, very gravelly silt loam.	GM, SM	10-50	30-75	25-60	20-45	15-40	3-20
53-3B----	Clay loam, gravelly clay loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
53-3C----	Clay loam-----------------	CL	0-5	85-95	80-90	55-80	15-40	3-20
54-1A----	Very gravelly sandy loam, very stony sandy loam.	GM, SM	10-50	30-75	25-60	12-30	---	NP
54-1B----	Very cobbly sandy loam----	SM	30-50	60-75	45-60	12-30	---	NP
54-1C----	Very cobbly sandy loam----	SM	30-50	60-75	45-60	12-30	---	NP
54-1E----	Very cobbly loam----------	SM	30-50	60-75	45-60	20-45	7-15	NP-4
54-1G----	Extremely cobbly sandy loam.	GM, SM	50-75	40-60	20-40	12-30	---	NP
54-2B----	Very cobbly clay loam, extremely cobbly sandy loam.	GM, SC, SM	30-75	40-75	20-60	12-45	7-40	NP-20
54-2C----	Extremely cobbly loam-----	GM, SM	50-75	40-60	25-50	20-45	7-15	NP-4
54-2D----	Very cobbly silt loam, very cobbly clay loam.	SC, SM	30-50	60-75	45-60	20-45	15-40	3-20
54-2E----	Gravelly loam, very cobbly sandy loam.	SM, ML	15-50	60-85	45-70	12-55	7-15	NP-4

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number-- 4	10	200	Liquid limit	Plasticity index
			Pct				Pct	
54-3A	Very cobbly silt loam, very cobbly clay loam, very cobbly loam.	SM	30-50	60-75	45-60	20-45	15-40	3-20
54-3C	Very gravelly silt loam, very cobbly silt loam.	GM, SM	10-50	30-75	25-60	20-45	15-40	3-20
54-3D	Clay loam	CL	0-5	85-95	80-90	55-80	15-40	3-20
54-3E	Very stony loam	SM	30-50	60-75	45-60	20-45	15-40	3-20
54-3F	Very cobbly loam, very stony loam.	SM	30-50	60-75	45-60	20-45	7-15	NP-4
54-5A	Very cobbly silt loam, very gravelly silt loam.	GM, SM	10-50	30-75	25-60	20-45	15-40	3-20
54-5C	Extremely stony loam, very stony loam.	GM, SM	30-75	40-75	20-60	20-45	15-40	3-20
61-2A	Very cobbly silt loam, very cobbly loam.	GM, SM	30-50	30-75	25-60	20-45	15-40	3-20
64-2A	Very cobbly loam, very cobbly sandy loam.	SM	30-50	60-75	45-60	12-30	7-15	NP-4
64-2C	Very stony loam, very cobbly loam.	SM	30-50	60-75	45-60	20-45	7-15	NP-4
66-1A	Sandy clay loam, gravelly sandy clay loam.	SC	5-10	75-85	55-65	20-55	15-40	3-20
71-1A	Gravelly clay loam, gravelly loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
71-1B	Clay loam, loam	CL	0-5	85-95	80-90	55-80	15-40	3-20
71-1C	Gravelly clay loam, gravelly loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
71-1D	Very stony loam, very cobbly sandy loam.	SM	30-50	60-75	45-60	12-25	7-15	3-20
71-1E	Gravelly clay loam, clay loam.	SC, CL	0-10	75-85	55-65	20-55	15-40	3-20
71-2A	Gravelly clay loam, gravelly loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
71-2B	Gravelly loam	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
71-2C	Clay loam, gravelly clay loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
71-2D	Loam, clay loam	CL	0-5	85-95	80-90	55-80	15-40	3-20
82-2B	Gravelly loam	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
82-2C	Gravelly loam, gravelly clay loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
84-1A	Clay loam, cobbly loam	CL, SC	0-15	85-90	65-70	20-55	15-40	3-20

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number-- 4	10	200	Liquid limit	Plasticity index
			Pct				Pct	
84-1B----	Stony clay loam-----------	SC, CL	10-15	85-90	65-70	20-55	15-40	3-20
84-2B----	Very stony loam, very cobbly loam.	SC	30-50	60-75	45-60	20-45	15-40	3-20
85-2A----	Extremely cobbly sandy loam, very cobbly clay loam.	GM, SC, SM	30-75	40-75	20-60	12-45	7-40	NP-20
85-2B----	Very stony loam, very cobbly sandy loam.	SM	30-50	60-75	45-60	12-25	7-15	NP-4
85-3A----	Very stony loam, very cobbly loam.	SC	30-50	60-75	45-60	20-45	15-40	3-20
85-3B----	Very stony loam, very cobbly loam.	SC	30-50	60-75	45-60	20-45	15-40	3-20
86-2A----	Gravelly loam, gravelly clay loam.	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
86-2C----	Gravelly clay loam--------	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
86-2D----	Gravelly loam, very stony loam.	SC, CL	15-40	60-85	45-65	20-55	15-40	3-20
86-2E----	Gravelly clay loam, clay loam.	SC, CL	0-10	75-85	55-65	20-55	15-40	3-20
86-3B----	Gravelly loam, clay loam--	SC, CL	0-10	75-85	55-65	20-55	15-40	3-20
86-3C----	Gravelly clay loam--------	SC, CL	5-10	75-85	55-65	20-55	15-40	3-20
87-1A----	Extremely cobbly loam, very cobbly loam.	GM, SM	30-75	40-75	20-60	20-45	7-15	NP-4
87-1B----	Extremely cobbly loam, very cobbly silt loam.	GM, SM	30-75	40-75	20-60	20-45	7-15	NP-4
87-1D----	Extremely cobbly sandy loam, extremely stony loam.	GM, SM	50-75	40-75	20-60	20-45	7-15	NP-4
87-2A----	Clay loam, gravelly clay loam.	SC, CL	0-10	75-85	55-65	20-55	15-40	3-20
87-2B----	Gravelly loam, extremely cobbly sandy loam.	GM, SM, ML	10-75	40-85	20-65	12-55	7-15	NP-4
87-2C----	Very cobbly loam, gravelly clay loam.	SC, CL	15-40	60-85	45-65	20-55	15-40	3-20
87-2D----	Very stony loam, extremely stony loam.	GM, SM	30-75	40-75	20-60	20-45	7-15	NP-4
87-2E----	Clay loam, gravelly clay loam.	SC, CL	0-10	75-85	55-65	20-55	15-40	3-20
88-1A----	Extremely cobbly sandy loam.	GM, SM	50-75	40-60	20-40	12-30	---	NP

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number-- 4	10	200	Liquid liquid	Plasticity index
			Pct				Pct	
88-2A----	Extremely stony loam, extremely cobbly sandy loam.	GM, SM	50-75	40-75	20-60	12-45	7-15	NP-4
91-2B----	Very stony loam, very cobbly loam.	SC	30-50	60-75	45-60	20-45	15-40	3-20
93-1A.								

TABLE 6.--FEATURES AFFECTING ROAD CONSTRUCTION COSTS

Map symbol	Wet areas	Hard bedrock	Drainage channels per mile	Slope complexity	Sediment hazard on roads
		Pct			
12-1A	Low	> 50	1 to 7	Low	Slight.
12-1C	Low	> 50	1 to 7	Low	Slight.
12-2A	Low	10-50	1 to 7	Low	Slight.
12-2B	Low	10-50	1 to 7	Low	Slight.
13-1A	Low	> 50	1 to 2	Low	Slight.
13-2A	Low	10-50	1 to 2	Low	Slight.
22-1A	Low	> 50	10 to 20	Moderate	Slight.
22-1B	Low	> 50	10 to 20	Moderate	Slight.
22-1C	Low	> 50	10 to 20	Moderate	Slight.
22-2A	Low	10-50	10 to 20	Moderate	Severe.
22-3A	Low	10-50	10 to 20	Moderate	Moderate.
22-3C	High	> 50	10 to 20	Moderate	Slight.
25-1A	Low	> 50	2 to 5	Low	Slight.
25-3A	Low	10-50	2 to 5	Low	Slight.
34-1A	Low	< 10	2 to 10	Moderate	Slight.
34-1B	Low	< 10	2 to 10	Moderate	Slight.
34-1C	Low	< 10	2 to 10	Moderate	Slight.
34-1D	Low	< 10	2 to 10	Moderate	Slight.
34-2C	Moderate	< 10	2 to 10	Moderate	Moderate.
34-2D	Low	< 10	2 to 10	Moderate	Moderate.
34-3A	Moderate	< 10	2 to 10	Moderate	Slight.
34-3B	Moderate	< 10	2 to 10	Moderate	Slight.
34-4B	Low	< 10	2 to 10	Moderate	Slight.
34-4C	Low	< 10	2 to 10	Moderate	Slight.
35-1A	Low	10-50	2 to 10	Moderate	Slight.
35-1B	Low	< 10	2 to 10	Moderate	Moderate.
35-1C	Low	< 10	2 to 10	Moderate	Moderate.
35-3A	Low	< 10	2 to 10	Moderate	Moderate.
35-3B	Moderate	< 10	2 to 10	Moderate	Moderate.
35-4C	Low	< 10	2 to 10	Moderate	Moderate.
46-1B	Low	< 10	2 to 10	Low	Slight.
46-2A	Low	< 10	1 to 5	Low	Slight.

TABLE 6.--FEATURES AFFECTING ROAD CONSTRUCTION COSTS--Continued

Map symbol	Wet areas	Hard bedrock	Drainage channels per mile	Slope complexity	Sediment hazard on roads
		Pct			
46-3A	Low	< 10	1 to 5	Low	Slight.
53-1A	Low	> 50	5 to 10	High	Slight.
53-1D	Moderate	> 50	5 to 10	High	Slight.
53-3A	Low	10-50	5 to 10	High	Slight.
53-3B	Low	10-50	5 to 10	High	Moderate.
53-3C	Low	10-50	5 to 10	High	Moderate.
54-1A	Low	> 50	8 to 15	Moderate	Slight.
54-1B	Low	> 50	8 to 15	Moderate	Slight.
54-1C	Low	> 50	8 to 15	Moderate	Slight.
54-1E	Low	> 50	8 to 15	Moderate	Slight.
54-1G	Low	> 50	8 to 15	Moderate	Slight.
54-2B	Low	> 50	8 to 15	Moderate	Slight.
54-2C	Low	> 50	8 to 15	Moderate	Slight.
54-2D	Low	10-50	8 to 15	Moderate	Severe.
54-2E	Low	10-50	8 to 15	Moderate	Moderate.
54-3A	Low	10-50	8 to 15	Moderate	Moderate.
54-3C	Low	10-50	8 to 15	Moderate	Moderate.
54-3D	Moderate	10-50	8 to 15	Moderate	Moderate.
54-3E	Low	10-50	8 to 15	Moderate	Severe.
54-3F	Low	10-50	8 to 15	Moderate	Slight.
54-5A	Low	10-50	8 to 15	Moderate	Slight.
54-5C	Low	10-50	8 to 15	Moderate	Slight.
61-2A	Low	< 10	1 to 5	Low	Slight.
64-2A	Low	< 10	1 to 5	Low	Slight.
64-2C	Moderate	< 10	1 to 5	Low	Slight.
66-1A	High	< 10	1 to 5	Low	Moderate.
71-1A	High	< 10	5 to 10	High	Severe.
71-1B	Low	< 10	5 to 10	High	Moderate.
71-1C	High	< 10	5 to 10	High	Severe.
71-1D	Low	< 10	5 to 10	High	Moderate.
71-1E	Moderate	< 10	5 to 10	High	Moderate.
71-2A	High	< 10	5 to 10	High	Severe.

TABLE 6.--FEATURES AFFECTING ROAD CONSTRUCTION COSTS--Continued

Map symbol	Wet areas	Hard bedrock	Drainage channels per mile	Slope complexity	Sediment hazard on roads
		Pct			
71-2B----	Low--------	< 10	5 to 10	High------	Moderate.
71-2C----	Moderate---	< 10	5 to 10	High------	Moderate.
71-2D----	Low--------	< 10	5 to 10	High------	Moderate.
82-2B----	Low--------	10-50	2 to 5	Low-------	Moderate.
82-2C----	Moderate---	10-50	2 to 5	Low-------	Moderate.
84-1A----	Moderate---	10-50	5 to 10	Low-------	Moderate.
84-1B----	Low--------	10-50	5 to 10	Low-------	Moderate.
84-2B----	Low--------	< 10	5 to 10	Low-------	Slight.
85-2A----	Low--------	> 50	5 to 10	Moderate	Slight.
85-2B----	Low--------	> 50	5 to 10	Moderate	Slight.
85-3A----	Low--------	10-50	5 to 10	Moderate	Slight.
85-3B----	Low--------	10-50	5 to 10	Moderate	Slight.
86-2A----	Low--------	10-50	5 to 10	Low-------	Moderate.
86-2C----	Low--------	10-50	5 to 10	Low-------	Moderate.
86-2D----	High-------	10-50	1 to 10	Low-------	Moderate.
86-2E----	Moderate---	10-50	1 to 10	Low-------	Moderate.
86-3B----	Low--------	< 10	1 to 5	Low-------	Slight.
86-3C----	Low--------	< 10	1 to 5	Low-------	Moderate.
87-1A----	Low--------	10-50	5 to 10	Moderate	Slight.
87-1B----	Low--------	10-50	5 to 10	Moderate	Slight.
87-1D----	Low--------	10-50	5 to 10	Moderate	Slight.
87-2A----	Low--------	10-50	5 to 10	Moderate	Severe.
87-2B----	Low--------	10-50	5 to 10	Moderate	Severe.
87-2C----	Low--------	10-50	5 to 10	Moderate	Severe.
87-2D----	Moderate---	10-50	5 to 10	Moderate	Severe.
87-2E----	Low--------	10-50	5 to 10	Moderate	Severe.
88-1A----	Low--------	10-50	1 to 5	Low-------	Slight.
88-2A----	Low--------	10-50	1 to 5	Low-------	Slight.
91-2B----	Low--------	10-50	0 to 2	Low-------	Moderate.
93-1A----	Low--------	> 50	0 to 2	Low-------	Slight.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation
12-1A	No limitations	No limitations	No limitations	Harsh climate.
12-1C	No limitations	No limitations	No limitations	No limitations.
12-2A	No limitations	No limitations	Slippery	No limitations.
12-2B	No limitations	No limitations	Slippery	Harsh climate.
13-1A	Hard rock	No limitations	Large stones	Harsh climate, moisture stress.
13-2A	No limitations	Cutbank slough, cutbank erosion.	Rut formation	Harsh climate.
22-1A	Slope, hard rock.	Cutbank ravel, avalanches.	Large stones	Harsh climate, moisture stress.
22-1B	Slope, hard rock.	Cutbank ravel	Large stones	No limitations.
22-1C	Slope, hard rock.	Cutbank ravel, avalanches.	Large stones	Harsh climate, moisture stress.
22-2A	Slope	Cutbank erosion, avalanches.	Rut formation	No limitations.
22-3A	Slope	Avalanches	No limitations	Moisture stress.
22-3C	Hard rock, wetness.	Cutbank ravel	Large stones	No limitations.
25-1A	Hard rock	Cutbank ravel	Large stones	Moisture stress, harsh climate.
25-3A	No limitations	Cutbank slough	Rut formation	Harsh climate, moisture stress.
34-1A	No limitations	Cutbank ravel	No limitations	Harsh climate.
34-1B	No limitations	Cutbank ravel	No limitations	No limitations.
34-1C	No limitations	Cutbank ravel, cutbank erosion.	No limitations	No limitations.
34-1D	No limitations	Cutbank ravel, cutbank erosion.	No limitations	No limitations.
34-2C	No limitations	Cutbank erosion, cutbank slough.	Rut formation	Harsh climate.
34-2D	No limitations	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
34-3A	No limitations	Cutbank slough	Slippery	Harsh climate.
34-3B	No limitations	Cutbank slough	Slippery	No limitations.
34-4B	No limitations	Cutbank slough	Slippery	No limitations.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE--Continued

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation
34-4C	No limitations	Cutbank erosion	Rut formation	No limitations.
35-1A	No limitations	Cutbank ravel, avalanches.	No limitations	Harsh climate, moisture stress.
35-1B	No limitations	Cutbank ravel, cutbank erosion.	No limitations	No limitations.
35-1C	No limitations	Cutbank ravel, cutbank erosion.	No limitations	No limitations.
35-2C	Slope	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
35-3A	Slope	No limitations	Slippery	Harsh climate.
35-3B	Slope	Cutbank slough, avalanches.	Slippery	No limitations.
35-4C	Slope	Cutbank erosion	Rut formation	No limitations.
46-1B	No limitations	No limitations	Large stones	No limitations.
46-2A	No limitations	Cutbank slough	Slippery	No limitations.
46-3A	No limitations	No limitations	No limitations	No limitations.
53-1A	Hard rock	No limitations	Large stones	No limitations.
53-1D	No limitations	No limitations	No limitations	No limitations.
53-3A	No limitations	No limitations	Slippery	No limitations.
53-3B	No limitations	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
53-3C	No limitations	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
54-1A	Slope, hard rock.	Cutbank ravel	Large stones	Moisture stress.
54-1B	Slope, hard rock.	Cutbank ravel	Large stones	Moisture stress.
54-1C	Hard rock.	Cutbank ravel	Large stones	Moisture stress.
54-1E	Slope, hard rock.	Avalanches	Large stones	Moisture stress.
54-1G	Slope, hard rock.	No limitations	Large stones	No limitations.
54-2B	Slope, hard rock.	No limitations	Large stones	Moisture stress.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE--Continued

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation
54-2C	Slope, hard rock.	Avalanches	Large stones	Moisture stress.
54-2D	Slope	Cutbank erosion	Rut formation	Moisture stress.
54-2E	Slope	Cutbank erosion, avalanches.	Slippery	Moisture stress.
54-3A	Slope	No limitations	Slippery	Moisture stress.
54-3C	Slope	No limitations	Slippery	Moisture stress.
54-3D	Slope	Cutbank erosion	Rut formation	No limitations.
54-3E	Slope	Avalanches	Slippery	No limitations.
54-3F	Slope	No limitations	Slippery	Moisture stress.
54-5A	Slope	No limitations	Slippery	Moisture stress.
54-5C	Slope	No limitations	Slippery	Moisture stress.
61-2A	No limitations	Cutbank erosion	Rut formation	No limitations.
64-2A	No limitations	Cutbank erosion, avalanches.	Rut formation	No limitations.
64-2C	Wetness	Flooding, cutbank erosion, avalanches.	No limitations	No limitations.
66-1A	Wetness	Flooding, cutbank erosion.	Rut formation	No limitations.
71-1A	Wetness	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
71-1B	No limitations	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
71-1C	Wetness	Cutbank slough, cutbank erosion.	Rut formation	Harsh climate.
71-1D	No limitations	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
71-1E	No limitations	Cutbank erosion	Rut formation	No limitations.
71-2A	Wetness	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
71-2B	No limitations	Cutbank erosion	Rut formation	No limitations.
71-2C	No limitations	Cutbank erosion	Rut formation	Harsh climate.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE--Continued

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation
71-2D------------	No limitations	Cutbank erosion	Rut formation	No limitations.
82-2B------------	No limitations	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
82-2C------------	No limitations	Cutbank slough, cutbank erosion.	Rut formation	Harsh climate.
84-1A------------	No limitations	Cutbank slough, cutbank erosion, avalanches.	Rut formation	No limitations.
84-1B------------	No limitations	Cutbank erosion	Rut formation	No limitations.
84-2B------------	No limitations	No limitations	Slippery-------	No limitations.
85-2A------------	Slope, hard rock.	No limitations	Large stones---	Moisture stress.
85-2B------------	Slope, hard rock.	Avalanches------	Large stones---	Moisture stress.
85-3A------------	Slope---------	No limitations	Slippery-------	Moisture stress.
85-3B------------	Slope---------	Avalanches------	Slippery-------	No limitations.
86-2A------------	No limitations	Cutbank erosion	Rut formation	No limitations.
86-2C------------	No limitations	Cutbank erosion	Rut formation	No limitations.
86-2D------------	Wetness-------	Cutbank slough, cutbank erosion.	Rut formation	No limitations.
86-2E------------	No limitations	Cutbank slough, cutbank erosion.	Rut formation	Harsh climate.
86-3B------------	No limitations	Cutbank erosion	Rut formation	No limitations.
86-3C------------	No limitations	Cutbank erosion	Rut formation	No limitations.
87-1A------------	Slope, hard rock.	Avalanches------	Large stone----	Moisture stress, harsh climate.
87-1B------------	Slope, hard rock.	Avalanches------	Large stones---	Moisture stress.
81-1D------------	Slope, hard rock.	Avalanches------	Large stones---	Moisture stress.
87-2A------------	Slope---------	Cutbank erosion, avalanches.	Rut formation	Moisture stress.
87-2B------------	Slope---------	Cutbank erosion, avalanches.	Rut formation	Moisture stress.
87-2C------------	Slope---------	Cutbank erosion	Rut formation	Moisture stress.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE--Continued

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation
87-2D------------	Slope---------	Avalanches------	Slippery-------	No limitations.
87-2E------------	Slope---------	Cutbank erosion, avalanches.	Rut formation	Moisture stress, harsh climate.
88-1A------------	No limitations	No limitations	Slippery-------	No limitations.
88-2A------------	No limitations	No limitations	Slippery-------	No limitations.
91-2B------------	No limitations	Avalanches------	Slippery-------	No limitations.
93-1A------------	Hard rock-----	Cutbank ravel, avalanches.	Large stones---	Moisture stress, harsh climate.

TABLE 8.--SOIL EROSION AND SLOPE STABILITY

Map symbol	Susceptibility of the soil to erosion		Sediment delivery efficiency	Risk of landslides
	Surface layer	Lower layer		
12-1A	Slight	Slight	Very low	Low.
12-1C	Moderate	Slight	Very low	Low.
12-2A	Slight	Slight	Very low	Low.
12-2B	Slight	Slight	Very low	Low.
13-1A	Slight	Slight	Very low	Low.
13-2A	Moderate	Moderate	Very low	Low.
22-1A	Slight	Slight	Moderate	Low.
22-1B	Moderate	Slight	Moderate	Low.
22-1C	Moderate	Slight	Moderate	Low.
22-2A	Moderate	Moderate	Moderate	High.
22-3A	Moderate	Slight	Moderate	Moderate.
22-3C	Moderate	Slight	Low	Low.
25-1A	Moderate	Slight	Low	Low.
25-3A	Moderate	Slight	Low	Low.
34-1A	Slight	Moderate	Low	Low.
34-1B	Moderate	Moderate	Low	Low.
34-1C	Moderate	Moderate	Low	Low.
34-1D	Moderate	Moderate	Low	Low
34-2C	Moderate	Moderate	Low	Moderate.
34-2D	Moderate	Moderate	Low	Moderate.
34-3A	Slight	Slight	Low	Low.
34-3B	Slight	Slight	Low	Low.
34-4B	Moderate	Slight	Low	Low.
34-4C	Moderate	Moderate	Low	Low.
35-1A	Slight	Slight	Moderate	Low.
35-1B	Moderate	Moderate	Moderate	Low.
35-1C	Moderate	Moderate	Moderate	Low.
35-2C	Moderate	Moderate	Moderate	Moderate.
35-3A	Slight	Slight	Moderate	Moderate.
35-3B	Slight	Slight	Moderate	Moderate.
35-4C	Moderate	Moderate	Moderate	Moderate.
46-1B	Moderate	Slight	Low	Low.

TABLE 8.--SOIL EROSION AND SLOPE STABILITY--Continued

Map symbol	Susceptibility of the soil to erosion: Surface layer	Susceptibility of the soil to erosion: Lower layer	Sediment delivery efficiency	Risk of landslides
46-2A	Moderate	Slight	Low	Low.
46-3A	Moderate	Slight	Low	Low.
53-1A	Moderate	Slight	Moderate	Low.
53-1D	Moderate	Slight	Moderate	Low.
53-3A	Moderate	Slight	Modeate	Low.
53-3B	Moderate	Moderate	Moderate	Low.
53-3C	Moderate	Moderate	Moderate	Low.
54-1A	Slight	Slight	High	Low.
54-1B	Moderate	Slight	High	Low.
54-1C	Moderate	Slight	High	Low.
54-1E	Slight	Slight	High	Low.
54-1G	Moderate	Slight	High	Low.
54-2B	Moderate	Slight	High	Low.
54-2C	Moderate	Slight	High	Low.
54-2D	Moderate	Moderate	High	High.
54-2E	Moderate	Moderate	High	High.
54-3A	Moderate	Slight	High	Moderate.
54-3C	Moderate	Slight	High	Moderate.
54-3D	Moderate	Moderate	High	Moderate.
54-3E	Slight	Slight	High	Moderate.
54-3F	Moderate	Slight	High	Low.
54-5A	Moderate	Slight	High	Low.
54-5C	Moderate	Slight	High	Low.
61-2A	Moderate	Slight	Low	Low.
64-2A	Moderate	Slight	High	Low.
64-2C	Moderate	Slight	High	Low.
66-1A	Moderate	Moderate	High	Low.
71-1A	Moderate	Moderate	Low	High.
71-1B	Moderate	Moderate	Low	Moderate.
71-1C	Moderate	Moderate	Low	High.
71-1D	Moderate	Moderate	Low	Moderate.

TABLE 8.--SOIL EROSION AND SLOPE STABILITY--Continued

Map symbol	Susceptibility of the soil to erosion: Surface layer	Susceptibility of the soil to erosion: Lower layer	Sediment delivery efficiency	Risk of landslides
71-1E	Moderate	Moderate	Low	Moderate.
71-2A	Moderate	Moderate	Low	High.
71-2B	Moderate	Moderate	Low	Moderate.
71-2C	Moderate	Moderate	Low	Moderate.
71-2D	Moderate	Moderate	Low	Moderate.
82-2B	Moderate	Moderate	Low	Moderate.
82-2C	Moderate	Moderate	Low	Moderate.
84-1A	Moderate	Moderate	Moderate	Moderate.
84-1B	Moderate	Moderate	Moderate	Moderate.
84-2B	Moderate	Slight	Low	Low.
85-2A	Moderate	Slight	Moderate	Low.
85-2B	Moderate	Slight	Moderate	Low.
85-3A	Moderate	Slight	Moderate	Low.
85-3B	Moderate	Slight	Moderate	Low.
86-2A	Moderate	Moderate	Moderate	Moderate.
86-2C	Moderate	Moderate	Moderate	Moderate.
86-2D	Moderate	Moderate	Moderate	Moderate.
86-2E	Moderate	Moderate	Low	Moderate.
86-3B	Moderate	Moderate	Low	Low.
86-3C	Moderate	Moderate	Moderate	Low.
87-1A	Moderate	Slight	Moderate	Low.
87-1B	Moderate	Slight	Moderate	Low.
87-1D	Moderate	Slight	Moderate	Low.
87-2A	Moderate	Moderate	Moderate	High.
87-2B	Moderate	Moderate	Moderate	High.
87-2C	Moderate	Moderate	Moderate	High.
87-2D	Moderate	Slight	Moderate	High.
87-2E	Moderate	Moderate	Moderate	High.
88-1A	Moderate	Slight	Very low	Low.
88-2A	Moderate	Slight	Low	Low.
91-2B	Moderate	Slight	Very low	Moderate.
93-1A	Slight	Slight	Very low	Low.

TABLE 9.--HERBAGE PRODUCTION

(Absence of an entry indicates data were not estimated)

Map symbol	Major vegetative group	Shrubs	Forbs	Grass
		lb/acre	lb/acre	lb/acre
12-1A	Upper subalpine forest	245	70	35
12-1C	Lower subalpine forest	210	105	35
12-2A	Lower subalpine forest	210	105	35
12-2B	Upper subalpine forest	245	70	35
13-1A	Alpine meadows	---	615	615
13-2A	Alpine meadows	---	680	680
22-1A	Lower subalpine forest	210	105	35
22-1B	Open-grown forest	40	120	240
	Mountain grassland	145	445	300
22-1C	Timberline forest	140	20	40
	Alpine meadows	---	360	360
22-2A	Lower subalpine forest	210	105	35
22-3A	Lower subalpine forest	210	105	35
22-3C	Lower subalpine forest	210	105	35
25-1A	Alpine meadows	---	615	615
25-3A	Alpine meadows	---	680	680
	Timberline forest	140	20	40
34-1A	Upper subalpine forest	245	70	35
34-1B	Mountain shrubland	225	705	480
34-1C	Lower subalpine forest	210	105	35
34-1D	Dense Douglas-fir forest	140	175	35
	Open-grown forest	40	120	240
34-2C	Upper subalpine forest	245	70	35
	Mountain meadows	---	1,290	935
34-2D	Lower subalpine forest	210	105	35
	Mountain meadows	---	1,290	935
34-3A	Upper subalpine forest	245	70	35
34-3B	Lower subalpine forest	210	105	35
34-4B	Lower subalpine forest	210	105	35
34-4C	Mountain shrubland	290	910	620
35-1A	Upper subalpine forest	245	70	35
35-1B	Mountain shrubland	200	200	400
35-1C	Lower subalpine forest	210	105	35

TABLE 9.--HERBAGE PRODUCTION--Continued

Map symbol	Major vegetative group	Shrubs	Forbs	Grass
		lb/acre	lb/acre	lb/acre
35-2C	Lower subalpine forest	210	105	35
	Mountain meadows	---	1,290	935
35-3A	Upper subalpine forest	245	70	35
	Mountain meadows	---	680	680
35-3B	Lower subalpine forest	210	105	35
35-4C	Mountain shrubland	290	910	620
46-1B	Mountain shrubland	200	200	400
46-2A	Mountain grassland	---	750	500
	Mountain shrubland	225	705	480
46-3A	Dense lodgepole pine forest	140	35	175
53-1A	Mountain grassland	---	750	500
	Mountain shrubland	225	705	480
53-1D	Lower subalpine forest	300	100	100
53-3A	Mountain shrubland	---	1,170	795
	Mountain grassland	375	980	655
53-3B	Lower subalpine forest	210	105	35
	Dense Douglas-fir forest	140	175	35
53-3C	Lower subalpine forest	300	100	100
54-1A	Mountain grassland	---	750	500
	Mountain shrubland	225	705	480
54-1B	Open-grown forest	40	120	240
	Lower subalpine forest	210	105	35
54-1C	Dense Douglas-fir forest	140	175	35
	Open-grown forest	40	120	240
54-1E	Upper subalpine forest	245	70	35
54-1G	Lower subalpine forest	210	105	35
54-2B	Open-grown forest	140	175	35
	Mountain grassland	---	750	500
54-2C	Lower subalpine forest	240	120	40
54-2D	Mountain grassland	---	750	500
	Dense Douglas-fir forest	140	175	35
54-2E	Lower subalpine forest	210	105	35
54-3A	Mountain grassland	---	980	655
	Mountain shrubland	375	1,170	750
54-3C	Dense Douglas-fir forest	140	175	35
	Mountain grassland	---	750	500
54-3D	Lower subalpine forest	300	100	100
	Dense Douglas-fir forest	190	30	80
54-3E	Upper subalpine forest	245	70	35

TABLE 9.--HERBAGE PRODUCTION--Continued

Map symbol	Major vegetative group	Shrubs	Forbs	Grass
		lb/acre	lb/acre	lb/acre
54-3F	Lower subalpine forest	50	150	300
	Upper subalpine forest	245	70	35
54-5A	Dense Douglas-fir forest	350	115	35
	Open-grown forest	40	120	240
54-5C	Dense Douglas-fir forest	350	115	35
	Open-grown forest	40	120	240
61-2A	Mountain grassland	---	980	655
	Mountain shrubland	290	910	620
64-2A	Mountain grassland	---	980	655
	Mountain shrubland	290	910	620
64-2C	Lower subalpine forest	700	560	140
66-1A	Riparian communities	210	640	2,550
71-1A	Lower subalpine forest	240	120	40
71-1B	Mountain grassland	---	980	655
	Mountain shrubland	375	1,170	795
	Lower subalpine forest	40	120	240
71-1C	Upper subalpine forest	245	70	35
71-1D	Lower subalpine forest	210	105	35
71-1E	Dense Douglas-fir forest	140	175	35
	Lower subalpine forest	240	120	40
71-2A	Lower subalpine forest	300	100	100
71-2B	Lower subalpine forest	210	105	35
71-2C	Upper subalpine forest	245	70	35
	Lower subalpine forest	240	120	40
71-2D	Mountain shrubland	290	---	---
	Dense Douglas-fir forest	140	175	35
82-2B	Lower subalpine forest	210	105	35
82-2C	Upper subalpine forest	245	70	35
	Lower subalpine forest	210	105	35
84-1A	Dense Douglas-fir forest	350	115	35
84-1B	Mountain grassland	---	980	655
	Mountain shrubland	290	910	620
84-2B	Lower subalpine forest	240	120	40
	Mountain grassland	---	980	655
85-2A	Open-grown forest	40	120	240
	Dense Douglas-fir forest	140	175	35
85-2B	Lower subalpine forest	240	120	40
	Dense Douglas-fir forest	140	175	35
85-3A	Dense Douglas-fir forest	140	175	35
	Mountain shrubland	225	705	480

TABLE 9.--HERBAGE PRODUCTION--Continued

Map symbol	Major vegetative group	Shrubs	Forbs	Grass
		lb/acre	lb/acre	lb/acre
85-3B	Lower subalpine forest	240	120	40
	Dense Douglas-fir forest	140	175	35
86-2A	Lower subalpine forest	240	120	40
	Mountain meadows	---	1,290	935
86-2C	Mountain grassland	---	980	955
	Mountain shrubland	295	910	620
86-2D	Lower subalpine forest	210	105	35
	Upper subalpine forest	245	70	35
86-2E	Mountain meadows	---	1,290	935
	Upper subalpine forest	245	70	35
86-3B	Lower subalpine forest	210	105	35
	Dense Douglas-fir forest	140	175	35
86-3C	Mountain shrubland	290	910	620
	Mountain grassland	---	980	655
87-1A	Timberline forest	140	20	40
	Alpine meadows	---	650	650
87-1B	Mountain grassland	---	750	500
	Mountain shrubland	225	705	480
87-1D	Lower subalpine forest	240	120	40
87-2A	Open-grown forest	40	120	240
	Mountain grassland	---	750	500
87-2B	Dense Douglas-fir forest	140	175	35
	Lower subalpine forest	210	105	35
87-2C	Mountain grassland	---	980	655
	Mountain shrubland	290	910	620
	Dense Douglas-fir forest	140	175	35
87-2D	Lower subalpine forest	240	120	40
87-2E	Upper subalpine forest	140	20	40
	Alpine meadows	---	1,290	935
88-1A	Lower subalpine forest	210	105	35
88-2A	Lower subalpine forest	210	105	35
91-2B	Lower subalpine forest	240	120	40
	Mountain meadows	---	1,290	935
93-1A.				

TABLE 10.--RANGE MANAGEMENT

(Absence of any entry indicates data were not estimated)

Map symbol	Forage production: Grassland-shrubland	Forage production: Forested areas: Under canopy	Forage production: Forested areas: Canopy removed	Range site	Livestock grazing
	lb/acre	lb/acre	lb/acre		
12-1A	---	35	125	None assigned	Severe: low productivity.
12-1C	---	25	160	None assigned	Severe: low productivity.
12-2A	---	25	225	None assigned	Moderate: low productivity.
12-2B	---	35	175	None assigned	Severe: low productivity.
13-1A	615	---	---	Shallow	Moderate: short season.
13-2A	680	---	---	Shallow	Moderate: short season.
22-1A	---	25	160	None assigned	Severe: low productivity.
22-1B	360	265	580	Thin breaks	Moderate: slope.
22-1C	410	20	50	Shallow	Severe: low productivity.
22-2A	---	25	180	Silty	Moderate: slope, low productivity.
22-3A	---	25	160	None assigned	Severe: low productivity.
22-3C	---	25	160	None assigned	Severe: low productivity.
25-1A	615	20	50	Shallow	Moderate: short season.
25-3A	720	20	70	Shallow	Moderate: short season.
34-1A	---	35	125	None assigned	Severe: low productivity.
34-1B	790	---	---	Stony	Slight.
34-1C	---	25	160	None assigned	Severe: low productivity.
34-1D	---	35	580	None assigned	Severe: scattered forage.
34-2C	1,110	35	140	Clayey	Moderate: scattered areas of forage, short growing season.

TABLE 10.--RANGE MANAGEMENT--Continued

Map symbol	Forage production: Grassland-shrubland	Forage production: Forested areas: Under canopy	Forage production: Forested areas: Canopy removed	Range site	Livestock grazing
	lb/acre	lb/acre	lb/acre		
34-2D	1,110	25	180	Clayey	Moderate: scattered areas of forage.
34-3A	---	35	175	None assigned	Severe: low productivity.
34-3B	---	25	225	None assigned	Moderate: low productivity.
34-4B	---	25	225	None assigned	Moderate: low productivity.
34-4C	730	---	---	Silty	Slight.
35-1A	---	35	125	None assigned	Severe: low productivity.
35-1B	440	---	---	Shallow to gravel	Moderate: slope.
35-1C	---	25	160	None assigned	Severe: low productivity.
35-2C	1,110	25	180	Clayey	Severe: scattered forage.
35-3A	680	35	175	Thin hilly	Moderate: low productivity.
35-3B	---	25	225	None assigned	Severe: low productivity.
35-4C	730	---	---	Silty	Moderate: slope.
46-1B	620	---	---	Silty and Shallow to gravel.	Slight.
46-2A	565-620	---	---	Silty and Shallow to gravel.	Slight.
46-3A	---	145	415	None assigned	Severe: low productivity.
53-1A	565-620	---	---	Thin breaks	Slight.
53-1D	---	50	225	None assigned	Moderate: low productivity.
53-3A	820-935	---	---	Silty	Slight.
53-3B	---	25	180	None assigned	Severe: low productivity.
53-3C	---	50	315	None assigned	Moderate: low productivity.

TABLE 10.--RANGE MANAGEMENT--Continued

Map symbol	Forage production: Grassland-shrubland	Forage production: Forested areas: Under canopy	Forage production: Forested areas: Canopy removed	Range site	Livestock grazing
	lb/acre	lb/acre	lb/acre		
54-1A	565-620	---	---	Thin breaks	Moderate: slope.
54-1B	---	265	580	None assigned	Moderate: slope.
54-1C	---	35-265	160-580	None assigned	Severe: low productivity.
54-1E	---	35	125	None assigned	Severe: low productivity.
54-1G	---	25	160	None assigned	Severe: low productivity.
54-2B	620	35	115	Thin breaks	Moderate: slope.
54-2C	---	35	145	None assigned	Severe: low productivity.
54-2D	620	35	180	Thin hilly	Moderate: slope.
54-2E	---	25	180	None assigned	Severe: low productivity.
54-3A	820-935	---	---	Silty	Moderate: slope.
54-3C	620	35	180	Thin breaks	Moderate: slope.
54-3D	---	35-50	210-315	None assigned	Severe: scattered ares of forage.
54-3E	---	35	175	None assigned	Severe: low productivity.
54-3F	---	35-165	175-555	None assigned	Severe: low productivity.
54-5A	---	20-265	140-340	None assigned	Moderate: slope.
54-5C	---	20-265	140-340	None assigned	Severe: low productivity.
61-2A	730-820	---	---	Limey and Silty	Slight.
64-2A	730-820	265	290	Limey and Silty	Slight.
64-2C	---	35	180	None assigned	Severe: low productivity.
66-1A	2,380	---	---	Wet land	Moderate: wetness.

TABLE 10.--RANGE MANAGEMENT--Continued

Map symbol	Forage production: Grassland-shrubland	Forage production: Forested areas: Under canopy	Forage production: Forested areas: Canopy removed	Range site	Livestock grazing
	lb/acre	lb/acre	lb/acre		
71-1A	---	30	225	None assigned	Severe: scattered areas of forage.
71-1B	820-935	30	225	Clayey subirrigated	Slight.
71-1C	---	35	140	None assigned	Severe: scattered areas of forage.
71-1D	---	25	195	None assigned	Severe: scattered areas of forage.
71-1E	---	30	150	None assigned	Severe: scattered areas of forage.
71-2A	---	50	315	None assigned	Severe: scattered areas of forage.
71-2B	---	25	225	None assigned	Moderate: scattered areas of forage.
71-2C	---	35	175	None assigned	Severe: scattered areas of forage.
71-2D	730	35	225	Silty	Slight.
82-2B	---	25	180	None assigned	Severe: low productivity.
82-2C	---	35	140	None assigned	Severe: low productivity.
84-1A	---	20	155	None assigned	Severe: scattered areas of forage.
84-1B	730-820	---	---	Silty	Slight.
84-2B	820	30	205	Silty	Severe: scattered areas of forage.
85-2A	---	35-250	115-405	None assigned	Moderate: slope.
85-2B	---	35	115	None assigned	Severe: low productivity.
85-3A	565	35	160	Thin breaks	Severe: scattered areas of forage.
85-3B	---	30	205	None assigned	Severe: low productivity.

TABLE 10.--RANGE MANAGEMENT--Continued

Map symbol	Forage production: Grassland-shrubland	Forage production: Forested areas: Under canopy	Forage production: Forested areas: Canopy removed	Range site	Livestock grazing
	lb/acre	lb/acre	lb/acre		
86-2A	1,110	30	225	Silty	Moderate: scattered areas of forage.
86-2C	730-820	---	---	Clayey	Slight.
86-2D	---	25	180	None assigned	Severe: low productivity.
86-2E	1,110	35	140	Subirrigated	Moderate: short growing season.
86-3B	---	25	160	None assigned	Severe: low productivity.
86-3C	730-820	---	---	Silty	Slight.
87-1A	650	20	35	Shallow	Severe: short growing season.
87-1B	565-620	---	---	Thin hilly	Moderate: slope.
87-1D	---	30	145	None assigned	Severe: low productivity.
87-2A	620	250	640	Thin hilly	Moderate: slope.
87-2B	---	25	180	None assigned	Severe: low productivity.
87-2C	730-820	35	180	Silty	Moderate: slope.
87-2D	---	30	225	None assigned	Severe: low productivity.
87-2E	1,110	20	55	Silty	Severe: scattered areas of forage, short growing season.
88-1A	---	25	210	None assigned	Severe: low productivity.
88-2A	---	25	210	None assigned	Severe: low productivity.
91-2B	1,110	30	225	Silty	Moderate: scattered areas of forage.
93-1A.					

TABLE 11.--POTENTIAL WILDLIFE HABITAT

Map symbol	Mule deer			Elk			Moose		
	Forage	Forage availability	Cover	Forage	Forage availablity	Cover	Forage	Forage availability	Cover
12-1A	Poor	Summer, fall	Good	Fair	Fall	Good	Fair	Fall, winter*	Good.
12-1C	Poor	Summer	Good	Fair	Summer, fall	Good	Good	Fall, winter*	Good.
12-2A	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Good	Fall, winter*	Good.
12-2B	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Fall, winter*	Good.
13-1A	Fair	Summer	Poor	Fair	Summer	Poor	Poor	Summer	Poor.
13-2A	Fair	Summer	Poor	Fair	Summer	Poor	Poor	Summer	Poor.
22-1A	Poor	Summer, fall	Good	Poor	Summer, fall	Good	Fair	Summer, fall	Poor.
22-1B	Fair	Year round	Fair	Fair	Fall, winter	Fair	Fair	Fall, winter	Fair.
22-1C	Poor	Summer	Good	Poor	Summer, fall	Poor	Poor	Summer	Poor.
22-2A	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Summer, fall	Good.
22-3A	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Summer, fall	Good.
22-3C	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Good	Summer, fall	Good.
25-1A	Fair	Summer	Fair	Good	Summer, fall	Fair	Fair	Summer, fall	Fair.
25-3A	Fair	Summer	Fair	Good	Summer, fall	Fair	Fair	Summer, fall	Fair.
34-1A	Fair	Summer	Good	Good	Summer, fall	Good	Fair	Year round*	Good.
34-1B	Good	Year round**	Poor	Fair	Fall, winter**	Poor	Poor	Fall**	Poor.
34-1C	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Good	Year round*	Good.
34-1D	Good	Summer, fall	Good	Good	Fall	Fair	Poor	Winter	Fair.
34-2C	Fair	Summer, fall	Good	Good	Summer, fall	Good	Good	Year round*	Good.
34-2D	Fair	Summer, fall	Good	Good	Summer, fall	Good	Good	Year round*	Good.
34-3A	Fair	Summer	Good	Good	Summer, fall	Good	Good	Year round*	Good.
34-3B	Poor	Summer	Good	Good	Summer, fall	Good	Good	Year round*	Good.
34-4B	Fair	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Year round*	Good.
34-4C	Good	Year round**	Poor	Good	Fall, winter**	Poor	Poor	Fall	Poor.
35-1A	Fair	Summer	Good	Fair	Summer, fall	Good	Fair	Summer, fall	Good.
35-1B	Good	All seasons	Poor	Good	Fall, winter	Poor	Poor	Fall	Poor.
35-1C	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Summer, fall	Good.
35-2C	Fair	Summer, fall	Good	Good	Summer, fall	Good	Good	Year round*	Good.
35-3A	Fair	Summer	Good	Good	Summer, fall	Good	Good	Summer, fall	Good.
35-3B	Poor	Summer	Good	Good	Summer, fall	Good	Good	Year round*	Good.
35-4C	Good	All seasons**	Poor	Good	Fall, winter**	Poor	Poor	Fall	Poor.
46-1B	Good	Winter	Poor	Good	Winter	Poor	Poor	Fall	Poor.

TABLE 11.--POTENTIAL WILDLIFE HABITAT--Continued

Map symbol	Mule deer			Elk			Moose		
	Forage	Forage availability	Cover	Forage	Forage availablity	Cover	Forage	Forage availability	Cover
46-2A---	Good	Winter	Poor	Good	Winter	Poor	Fair	Fall, winter***	Poor.
46-3A---	Fair	Summer	Fair	Fair	Fall	Fair	Fair	Summer, fall	Fair.
53-1A---	Good	Year round	Poor	Good	Fall, winter	Poor	Poor	Fall	Poor.
53-1D---	Poor	Summer, fall	Good	Fair to good.	Summer, fall	Good	Good	Year round*	Good.
53-3A---	Good	Fall, winter	Poor	Good	Fall, winter	Poor	Poor	Fall	Poor.
53-3B---	Good	Summer, fall	Good	Good	Fall	Good	Fair	Fall	Good.
53-3C---	Fair	Summer, fall	Good	Good	Summer, fall	Good	Good	Fall, winter*	Good.
54-1A---	Good	Year round	Fair	Good	Fall, winter	Fair	Poor	Fall	Poor.
54-1B---	Fair	Summer, fall	Good	Good	Fall	Good	Poor	Fall	Good.
54-1C---	Good	Summer, fall	Good	Fair	Fall	Good	Fair	Fall	Good.
54-1E---	Fair	Summer, fall	Good	Fair	Fall	Good	Poor	Fall	Good.
54-1G---	Good	Summer, fall	Good	Fair	Fall	Good	Fair	Fall	Good.
54-2B---	Fair	Year round	Fair	Fair	Fall, winter	Fair	Poor	Fall	Fair.
54-2C---	Fair	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Summer, fall	Good.
54-2D---	Good	Fall, winter	Poor	Fair to good.	Winter	Poor	Poor	Winter	Poor.
54-2E---	Fair	Summer, fall	Good	Fair	Fall	Good	Poor	Fall	Good.
54-3A---	Good	Fall, winter	Poor	Good	Fall, winter	Poor	Poor	Fall	Poor.
54-3C---	Good	Fall, winter	Fair	Fair	Fall, winter	Fair	Poor	Fall	Fair.
54-3D---	Poor	Summer, fall	Good	Good	Summer, fall	Good	Good	Summer, fall	Good.
54-3E---	Poor	Summer, fall	Good	Fair	Summer, fall	Good	Fair	Fall	Good.
54-3F---	Fair	Summer, fall	Good	Good	Fall	Good	Fair	Fall	Good.
54-5A---	Good	All seasons	Good	Good	Fall, winter	Fair	Poor	Fall	Fair.
54-5C---	Good	Summer, fall	Good	Fair	Fall	Good	Fair	Fall	Good.
61-2A---	Fair	Fall	Poor	Fair	Fall	Poor	Fair	Fall***	Poor.
64-2A---	Fair	All seasons	Poor	Fair	Winter	Poor	Good	Fall, winter***	Poor.
64-2C---	Poor	Summer	Good	Good	Summer, fall	Good	Good	Year round*	Good.
66-1A---	Poor	Summer	Fair	Good	Summer	Poor	Good	Year round*	Fair.
71-1A---	Poor	Summer	Good	Good	Summer	Good	Good	Year round*	Good.
71-1B---	Good	Fall, winter**	Poor	Good	Fall, winter**	Poor	Poor	Fall	Poor.
71-1C---	Poor	Summer, fall	Good	Good	Summer, fall	Good	Good	Year round*	Good.
71-1D---	Fair	Summer, fall	Good	Good	Summer, fall	Good	Fair	Year round*	Good.

TABLE 11.--POTENTIAL WILDLIFE HABITAT--Continued

Map symbol	Mule deer: Forage	Mule deer: Forage availability	Mule deer: Cover	Elk: Forage	Elk: Forage availablity	Elk: Cover	Moose: Forage	Moose: Forage availability	Moose: Cover
71-1E---	Good	Summer, fall	Fair	Good	Fall	Fair	Fair	Fall, winter	Fair.
71-2A---	Poor	Summer	Good	Good	Summer, fall	Good	Good	Year round*	Good.
71-2B---	Fair	Summer	Good	Fair	Summer	Good	Good	Year round*	Good.
71-2C---	Poor	Summer	Good	Good	Summer	Good	Good	Year round*	Good.
71-2D---	Good	Fall, winter**	Poor	Good	Fall, winter**	Poor	Poor	Fall	Poor.
82-2B---	Fair	Summer	Good	Good	Fall	Good	Good	Fall, winter*	Good.
82-2C---	Fair	Summer	Good	Good	Summer	Good	Good	Summer, fall	Good.
84-1A---	Fair	Summer, fall	Good	Good	Summer, fall	Good	Good	Year round*	Good.
84-1B---	Good	Fall, winter	Fair	Good	Fall, winter	Poor	Poor	Fall	Poor.
84-2B---	Good	Summer, fall	Good	Fair	Fall	Good	Good	Fall, winter	Fair.
85-2A---	Good	Year round	Good	Fair	Fall	Good	Poor	Fall	Good.
85-2B---	Good	Summer	Good	Fair	Summer	Good	Fair	Summer, fall	Good.
85-3A---	Good	Year round	Good	Fair	Fall	---	Poor	Fall	Good.
85-3B---	Good	Summer, fall	Good	Fair	Summer, fall	---	Fair	Fall	Good.
86-2A---	Fair	Summer	Fair	Good	Summer, fall	Fair	Good	Summer, fall	Good.
86-2C---	Good	Summer, fall**	Poor	Good	Fall, winter**	Poor	Fair	Fall, winter***	Poor.
86-2D---	Fair	Summer	Good	Good	Summer, fall	Good	Good	Year round*	Good.
86-2E---	Fair	Summer	Good	Good	Summer, fall	Good	Good	Summer, fall	Good.
86-3B---	Fair	Summer, fall	Good	Fair	Fall	Good	Fair	Year round*	Good.
86-3C---	Good	Summer, fall	Poor	Fair	Fall	Poor	Poor	Fall	Poor.
87-1A---	Fair	Summer, fall	Good	Good	Summer, fall	Good	Fair	Summer	Fair.
87-1B---	Fair	Year round	Poor	Fair	Fall, winter	Poor	Poor	Fall	Poor.
87-1D---	Fair	Summer	Good	Poor	Summer	Good	Fair	Fall	Good.
87-2A---	Good	Summer, fall	Good	Good	Fall	Fair	Fair	Fall	Fair.
87-2B---	Fair	Summer	Good	Good	Fall	Good	Good	Year round*	Good.
87-2C---	Good	Summer, fall**	Fair	Fair	Fall, winter**	Fair	Poor	Fall	Poor.
87-2D---	Fair	Summer	Good	Good	Summer	Good	Good	Summer, fall	Good.
87-2E---	Fair	Summer	Good	Good	Summer, fall	Good	Good	Summer, fall	Good.
88-1A---	Poor	Summer	Good	Poor	Summer	Good	Poor	Fall	Good.
88-2A---	Poor	Summer	Good	Fair	Summer, fall	Good	Poor	Fall	Good.

TABLE 11.--POTENTIAL WILDLIFE HABITAT--Continued

Map symbol	Mule deer			Elk			Moose		
	Forage	Forage availability	Cover	Forage	Forage availablity	Cover	Forage	Forage availability	Cover
91-2B---	Poor	Summer	Fair	Fair	Summer, fall	Fair	Fair	Summer, fall	Fair.
93-1A---	Poor	Summer	Poor	Poor	Summer	Poor	Poor	Summer	Poor.

* The forage is available in winter only if the vegetation includes old growth forest that has numerous subalpine fir seedlings in the understory.

** The forage is available during late fall and winter only in some areas of the map unit.

*** The forage is restricted to areas along streams and springs and in seeps.

TABLE 12.--CLASSIFICATION OF THE SOILS (GROUPED BY SUBORDER)

Suborder	Soil name
Aquents	Cryaquents
Aquolls	Cryaquolls
Boralfs	Aquic Cryoboralfs, fine-loamy, mixed Mollic Cryoboralfs, fine-loamy, mixed Mollic Cryoboralfs, loamy-skeletal, mixed Typic Cryoboralfs, fine-loamy, mixed Typic Cryoboralfs, loamy-skeletal, mixed Mollic Eutroboralfs, loamy-skeletal, mixed
Borolls	Aridic Argiborolls, loamy-skeletal, mixed Pachic Argiborolls, loamy-skeletal, mixed Typic Argiborolls, fine-loamy, mixed Typic Argiborolls, loamy-skeletal, mixed Typic Calciborolls, loamy-skeletal, carbonatic Argic Cryoborolls, fine-loamy, mixed Argic Cryoborolls, fine, mixed Argic Cryoborolls, loamy-skeletal, mixed Argic Pachic Cryoborolls, fine-loamy, mixed Argic Pachic Cryoborolls, loamy-skeletal, mixed Typic Cryoborolls, loamy-skeletal, mixed Typic Haploborolls, loamy-skeletal, mixed
Ochrepts	Dystric Cryochrepts, loamy-skeletal, mixed Dystric Cryochrepts, sandy-skeletal, mixed Typic Cryochrepts, loamy-skeletal, mixed Typic Cryochrepts, sandy-skeletal, siliceous Typic Ustochrepts, loamy-skeletal, mixed, frigid

TABLE 13.--CLASSIFICATION OF THE SOILS IN THE DETAILED SOIL MAP UNITS

Map symbol	Family or higher taxonomic classification
12-1A	Dystric Cryochrepts, loamy-skeletal, mixed
12-1C	Typic Cryochrepts, loamy-skeletal, mixed
12-2A	Mollic Cryoboralfs, loamy-skeletal, mixed
12-2B	Mollic Cryoboralfs, loamy-skeletal, mixed
13-1A	Dystric Cryochrepts, sandy-skeletal, mixed
13-2A	Typic Cryochrepts, loamy-skeletal; mixed; Argic Cryoborolls, fine-loamy, mixed
22-1A	Dystric Cryochrepts, sandy-skeletal, mixed
22-1B	Typic Ustochrepts, loamy-skeletal, mixed, frigid; Typic Haploborolls, loamy-skeletal, mixed
22-1C	Typic Cryochrepts, loamy-skeletal, mixed
22-2A	Typic Cryoboralfs, loamy-skeletal, mixed; Typic Cryochrepts, loamy-skeletal, mixed
22-3A	Typic Cryochrepts, loamy-skeletal, mixed
22-3C	Typic Cryochrepts, loamy-skeletal, mixed; Cryaquolls
25-1A	Dystric Cryochrepts, loamy-skeletal, mixed
25-3A	Argic Cryoborolls, fine-loamy, mixed; Typic Cryoboralfs, fine-loamy, mixed
34-1A	Dystric Cryochrepts, loamy-skeletal, mixed
34-1B	Argic Cryoborolls, loamy-skeletal, mixed; Typic Cryoborolls, loamy-skeletal, mixed
34-1C	Typic Cryochrepts, loamy-skeletal, mixed
34-1D	Typic Cryochrepts, loamy-skeletal, mixed; Typic Cryoborolls, loamy-skeletal, mixed
34-2C	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
34-2D	Typic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, loamy-skeletal, mixed
34-3A	Mollic Cryoboralfs, loamy-skeletal, mixed
34-3B	Mollic Cryoboralfs, loamy-skeletal, mixed
34-4B	Typic Cryoboralfs, loamy-skeletal, mixed
34-4C	Argic Cryoborolls, fine-loamy, mixed; Argic Pachic Cryoborolls, fine-loamy, mixed
35-1A	Dystric Cryochrepts, loamy-skeletal, mixed
35-1B	Argic Cryoborolls, loamy-skeletal, mixed; Argic Pachic Cryoborolls, loamy-skeletal, mixed

TABLE 13.--CLASSIFICATION OF THE SOILS IN THE DETAILED SOIL MAP UNITS--Continued

Map symbol	Family or higher taxonomic classification
35-1C	Typic Cryochrepts, loamy-skeletal, mixed
35-2C	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
35-3A	Mollic Cryoboralfs, loamy-skeletal, mixed
35-3B	Mollic Cryoboralfs, loamy-skeletal, mixed
35-4C	Argic Cryoborolls, fine-loamy, mixed; Argic Pachic Cryoborolls, fine-loamy, mixed
46-1B	Typic Argiborolls, loamy-skeletal, mixed; Aridic Argiborolls, loamy-skeletal, mixed
46-2A	Typic Argiborolls, loamy-skeletal, mixed; Aridic Argiborolls, loamy-skeletal, mixed
46-3A	Typic Cryochrepts, sandy-skeletal, siliceous
53-1A	Typic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed
53-1D	Typic Cryochrepts, loamy-skeletal, mixed
53-3A	Argic Cryoborolls, loamy-skeletal, mixed; Argic Pachic Cryoborolls, loamy-skeletal, mixed
53-3B	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
53-3C	Mollic Cryoboralfs, fine-loamy, mixed
54-1A	Typic Hapoborolls, loamy-skeletal, mixed; Typic Ustochrepts, loamy-skeletal, mixed, frigid
54-1B	Typic Cryochrepts, loamy-skeletal, mixed; Typic Cryoborolls, loamy-skeletal, mixed
54-1C	Typic Cryochrepts, loamy-skeletal, mixed
54-1E	Dystric Cryochrepts, loamy-skeletal, mixed
54-1G	Typic Cryochrepts, loamy-skeletal, mixed
54-2B	Typic Ustochrepts, loamy-skeletal, mixed, frigid; Typic Calciborolls, loamy-skeletal, carbonatic
54-2C	Typic Cryochrepts, loamy-skeletal, mixed
54-2D	Typic Argiborolls, loamy-skeletal, mixed; Typic Ustochrepts, loamy-skeletal, mixed, frigid
54-2E	Typic Cryoboralfs, fine-loamy, mixed; Typic Cryochrepts, loamy-skeletal, mixed
54-3A	Typic Argiborolls, loamy-skeletal, mixed; Pachic Argiborolls, loamy-skeletal, mixed
54-3C	Mollic Eutroboralfs, loamy-skeletal, mixed; Typic Argiborolls, loamy-skeletal, mixed

TABLE 13.--CLASSIFICATION OF THE SOILS IN THE DETAILED SOIL MAP UNITS--Continued

Map symbol	Family or higher taxonomic classification
54-3D	Mollic Cryoboralfs, fine-loamy, mixed
54-3E	Mollic Cryoboralfs, loamy-skeletal, mixed
54-3F	Argic Cryoborolls, loamy-skeletal, mixed; Mollic Cryoboralfs, loamy-skeletal, mixed
54-5A	Typic Argiborolls, loamy-skeletal, mixed; Mollic Eutroboralfs, loamy-skeletal, mixed
54-5C	Typic Cryoboralfs, loamy-skeletal, mixed; Mollic Cryoboralfs, loamy-skeletal, mixed
61-2A	Typic Argiborolls, loamy-skeletal, mixed; Typic Calciborolls, loamy-skeletal, carbonatic
64-2A	Typic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed
64-2C	Typic Cryoboralfs, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed
66-1A	Cryaquolls; Cryaquents
71-1A	Aquic Cryoboralfs, fine-loamy, mixed; Typic Cryoboralfs, fine-loamy, mixed
71-1B	Argic Cryoborolls, fine-loamy, mixed; Argic Pachic Cryoborolls, fine-loamy, mixed
71-1C	Typic Cryoboralfs, fine-loamy, mixed; Aquic Cryoboralfs, fine-loamy, mixed
71-1D	Typic Cryoboralfs, loamy-skeletal, mixed; Typic Cryochrepts, loamy-skeletal, mixed
71-1E	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
71-2A	Typic Cryoboralfs, fine-loamy, mixed; Aquic Cryoboralfs, fine-loamy, mixed
71-2B	Typic Cryoboralfs, fine-loamy, mixed
71-2C	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
71-2D	Argic Cryoborolls, fine-loamy, mixed; Mollic Cryoboralfs, fine-loamy, mixed
82-2B	Typic Cryoboralfs, fine-loamy, mixed
82-2C	Typic Cryoboralfs, fine-loamy, mixed; Aquic Cryoboralfs, fine-loamy, mixed
84-1A	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine, mixed
84-1B	Typic Argiborolls, fine-loamy, mixed
84-2B	Mollic Cryoboralfs, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed

TABLE 13.--CLASSIFICATION OF THE SOILS IN THE DETAILED SOIL MAP UNITS--Continued

Map symbol	Family or higher taxonomic classification
85-2A	Typic Calciborolls, loamy-skeletal, carbonatic; Typic Ustochrepts, loamy-skeletal, mixed, frigid
85-2B	Typic Cryoboralfs, loamy-skeletal, mixed; Typic Cryochrepts, loamy-skeletal, mixed
85-3A	Mollic Cryoboralfs, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed
85-3B	Mollic Cryoboralfs, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed
86-2A	Typic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
86-2C	Argic Cryoborolls, fine-loamy, mixed
86-2D	Typic Cryoboralfs, fine-loamy, mixed; Mollic Cryoboralfs, loamy-skeletal, mixed
86-2E	Argic Cryoborolls, fine-loamy, mixed; Mollic Cryoboralfs, fine-loamy, mixed
86-3B	Typic Cryoboralfs, fine-loamy, mixed; Mollic Cryoboralfs, fine-loamy, mixed
86-3C	Argic Cryoborolls, fine-loamy, mixed; Typic Cryoborolls, loamy-skeletal, mixed
87-1A	Typic Cryochrepts, loamy-skeletal, mixed; Typic Cryoborolls, loamy-skeletal, mixed
87-1B	Typic Calciborolls, loamy-skeletal, carbonatic; Typic Argiborolls, loamy-skeletal, mixed
87-1D	Typic Cryochrepts, loamy-skeletal, mixed; Typic Cryoboralfs, loamy-skeletal, mixed
87-2A	Mollic Cryoboralfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
87-2B	Typic Cryoboralfs, fine-loamy, mixed; Typic Cryochrepts, loamy-skeletal, mixed
87-2C	Argic Cryoborolls, fine-loamy, mixed; Argic Cryoborolls, loamy-skeletal, mixed
87-2D	Mollic Cryoboralfs, loamy-skeletal, mixed; Typic Cryoboralfs, loamy-skeletal, mixed
87-2E	Mollic Cryoborolfs, fine-loamy, mixed; Argic Cryoborolls, fine-loamy, mixed
88-1A	Typic Cryochrepts, loamy-skeletal, mixed
88-2A	Typic Cryoboralfs, loamy-skeletal, mixed; Typic Cryochrepts, loamy-skeletal, mixed
91-2B	Mollic Cryoboralfs, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed

TABLE 14.--SIZE AND DENSITY OF ROOTS IN THE SOILS IN THE SURVEY AREA

Vegetation	Root characteristics*		
	Surface layer	Subsoil	Substratum
Forested, nongrassy understory	Few fine and medium roots, many coarse roots, few very coarse roots.	Few coarse and few very coarse roots.	Few very coarse roots.
Forested, grassy understory	Many fine and medium roots, many coarse roots, few very coarse roots.	Few coarse and few very coarse roots.	Few very coarse roots.
Nonforested, grasses or forbs	Many fine and medium roots	Common fine and medium roots.	Few medium roots.
Nonforested, alpine turf	Many fine and medium roots	Few fine and medium roots.	Few fine roots.

* Very coarse roots are more than 20 millimeters in diameter.

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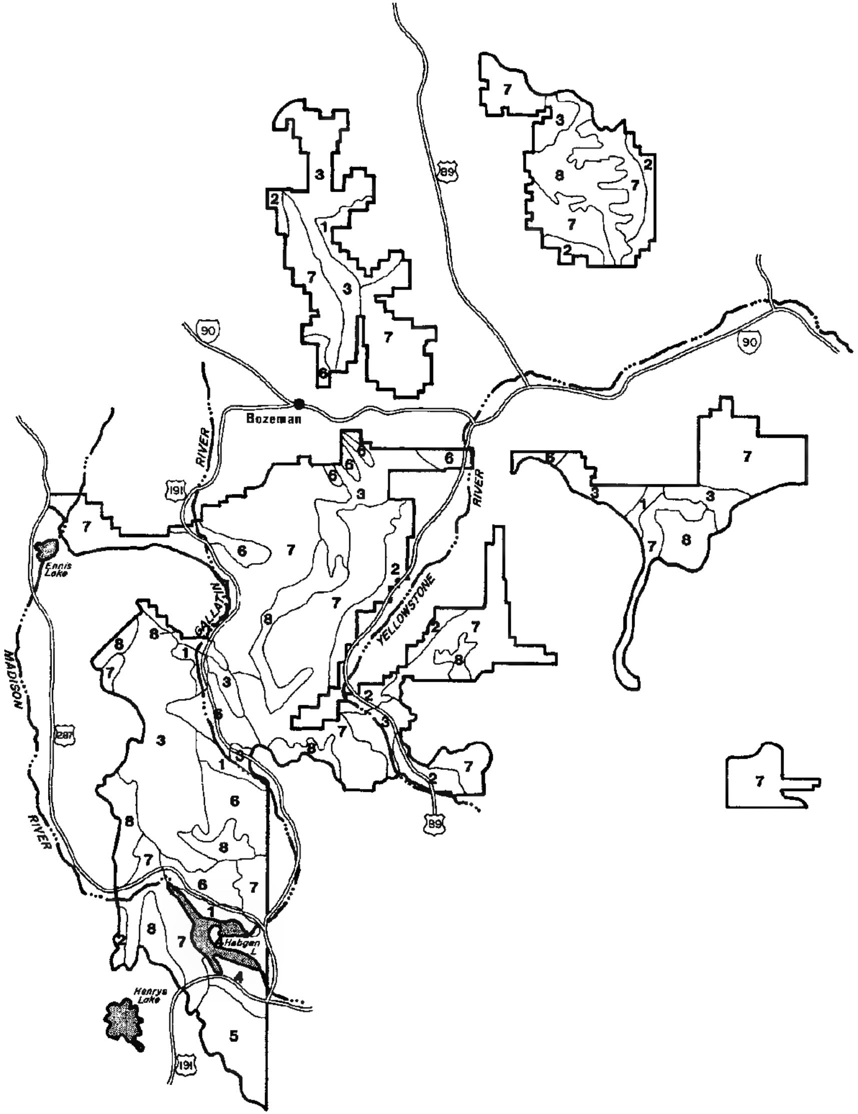


General Soil Map

GALLATIN NATIONAL FOREST AREA, MONTANA

APPROX. SCALE

0 5 10 Miles

N

SOIL LEGEND*

SOILS AT LOW ELEVATIONS ON MOUNTAIN SLOPES AND IN VALLEYS

1 Soils on flood plains, terraces, and alluvial fans

2 Soils at low elevations on mountain slopes

SOILS AT MID ELEVATIONS ON MOUNTAIN SLOPES

3 Soils underlain by interbedded sandstone and shale

4 Soils underlain by glacial outwash

5 Soils underlain by rhyolitic rocks

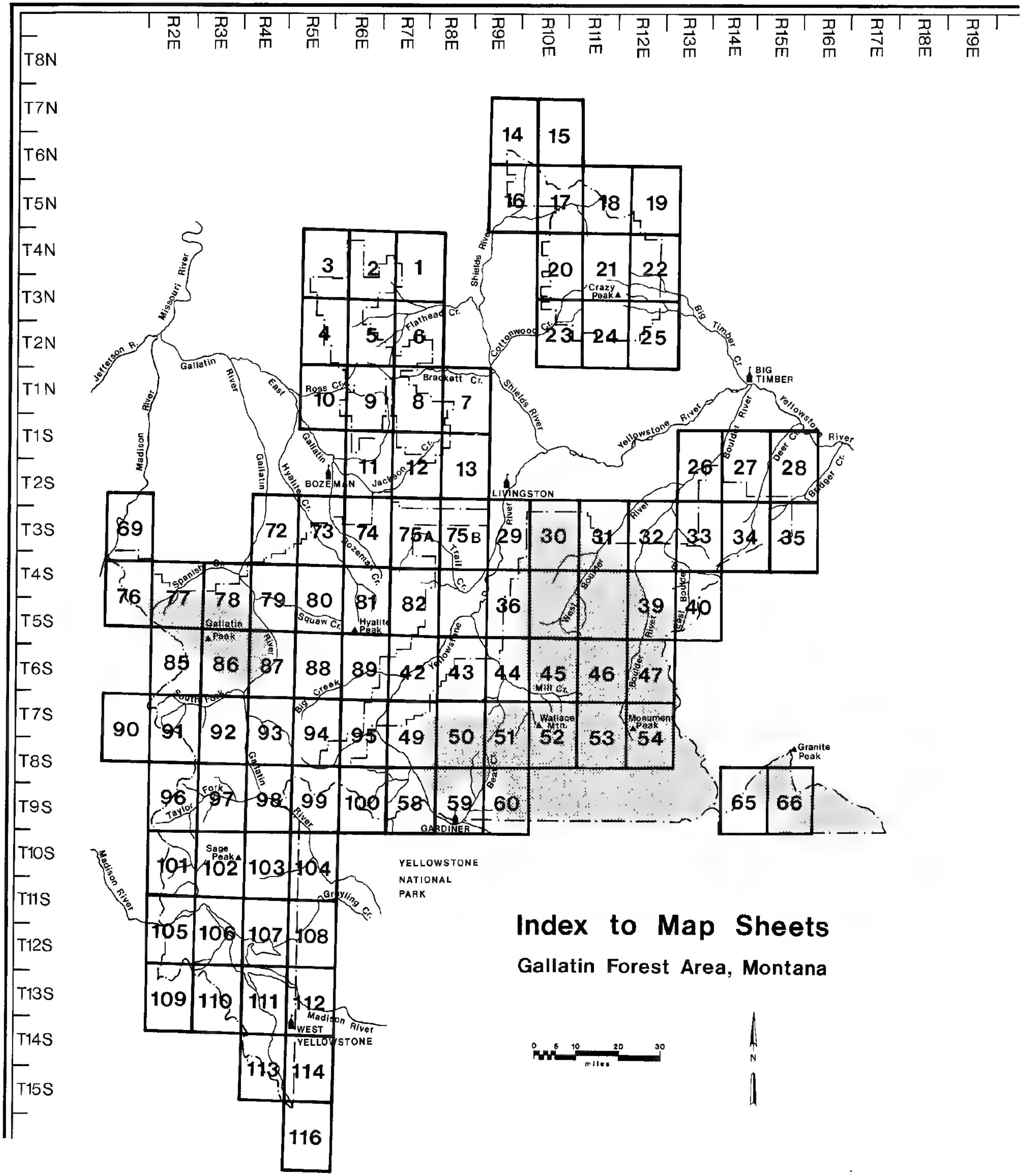
6 Soils underlain by limestone

7 Soils underlain by granitic or volcanic rock

SOILS AT HIGH ELEVATIONS ON MOUNTAIN SLOPES AND RIDGES

8 Soils formed under upper subalpine and timberline forests and alpine meadows

*The units on this legend are described in the text under the heading "General Soil Map Units."



Index to Map Sheets

Gallatin Forest Area, Montana

SHEET NUMBER 1
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

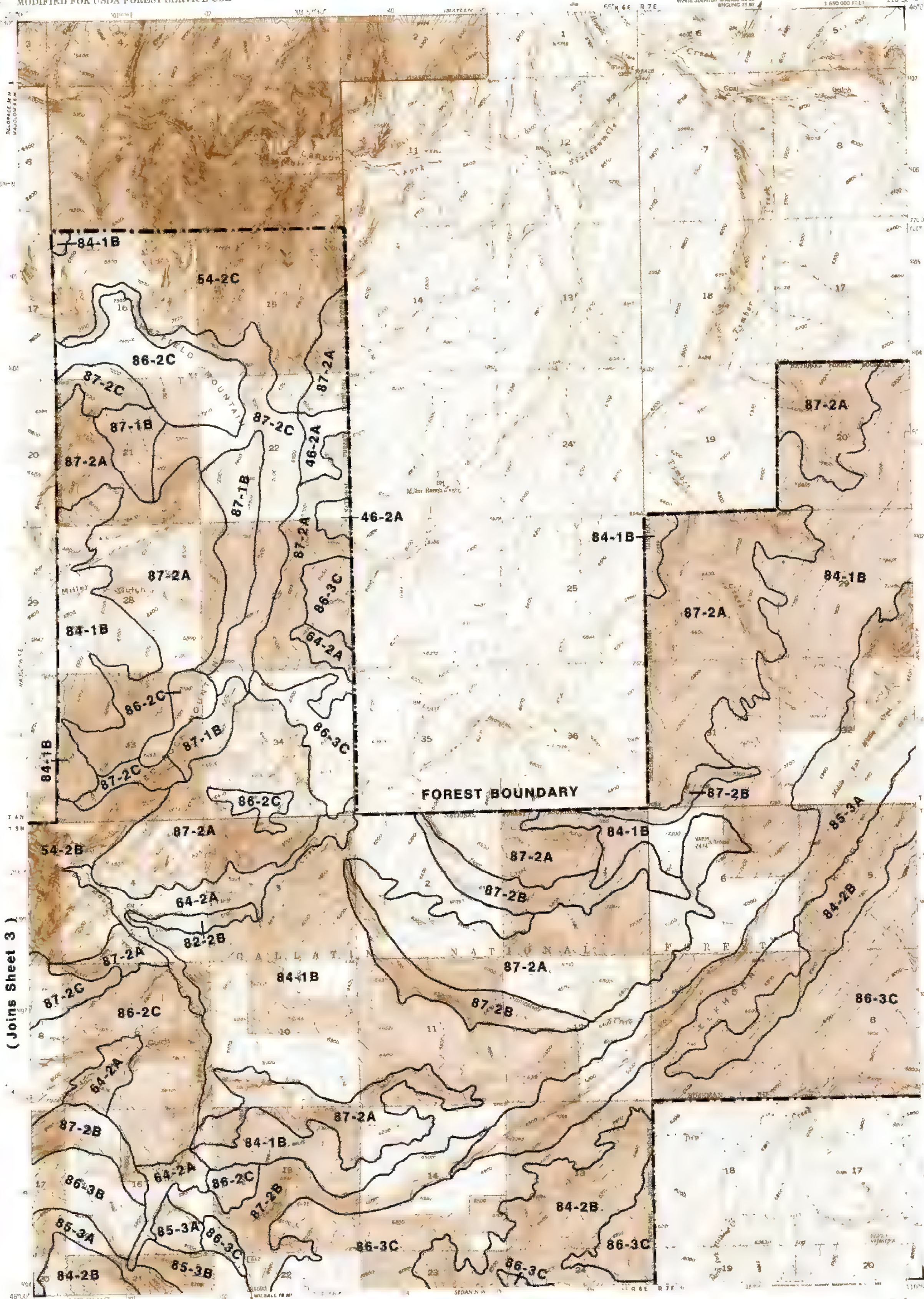
This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

SHEET NUMBER 2
GALLATIN FOREST AREA SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

HATFIELD MOUNTAIN QUADRANGLE
MONTANA-GALLATIN CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 5)

Base map prepared by the U.S. Geological Survey
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereophotogrammetric methods 1948. Aerial photographs taken 1947
Field check 1948 and 1951

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system south zone

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

- Wilderness Boundary
- National Forest Boundary
- Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Unreliable
- Unsurveyed, BLM Protraction

- Primary Highway
- Secondary Highway
- Light Duty Road
- Primitive Road
- Trail
- Interstate
- U.S. Highway
- State Highway
- County Highway
- Forest Road
- Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

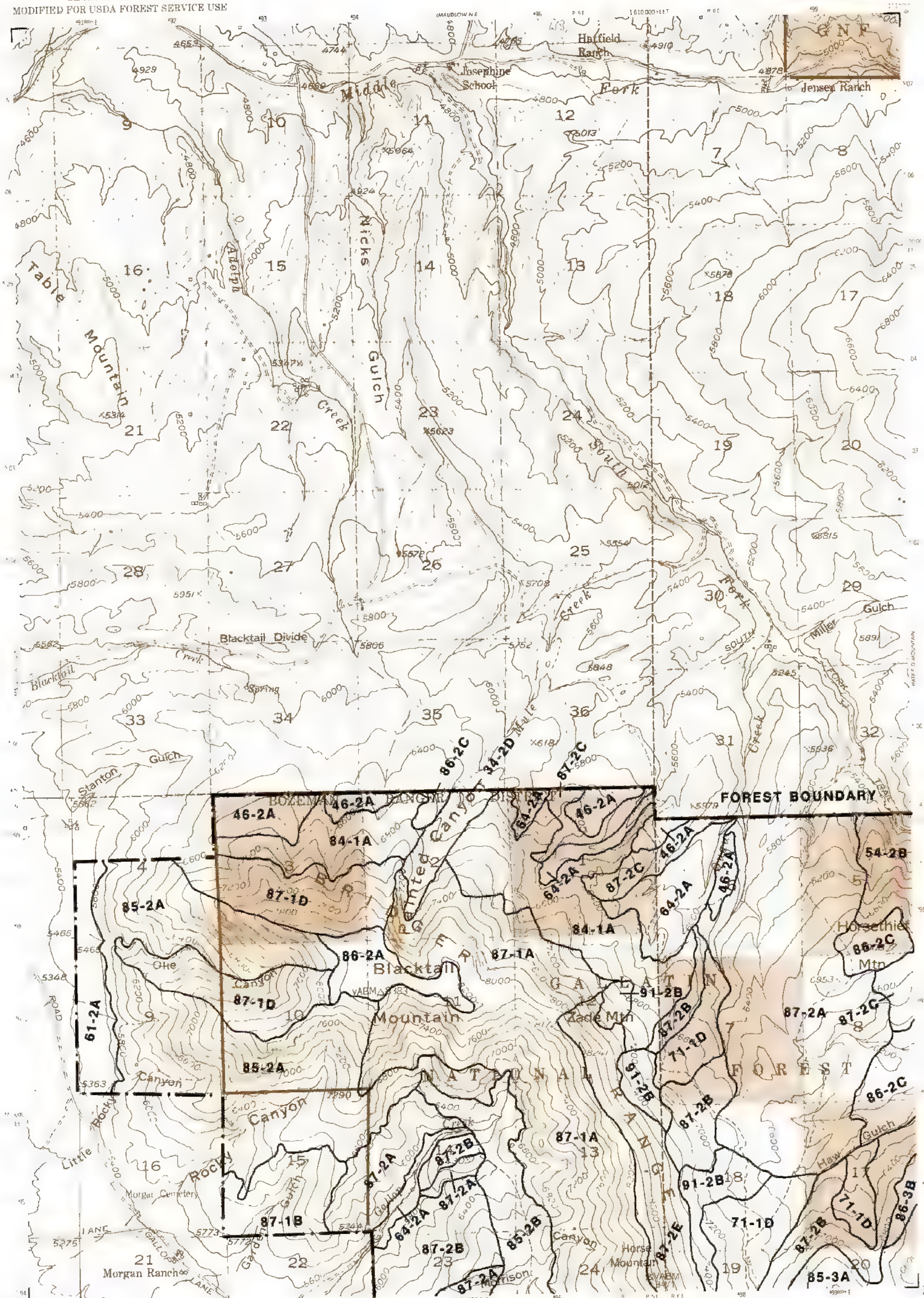
HATFIELD MOUNTAIN, MONT.
N4600—W11052.5/7.5
1951

SHEET NUMBER 3
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MAUDLOW S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



Base map prepared by the U.S. Geological Survey
Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS, USC&GS, and USFS
Topography from aerial photographs by stereoplanigraph methods
Aerial photographs taken 1947. Field check 1949
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, central and south zones
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MAUDLOW S.E., MONT.
N4600—W11100/7.5
1949

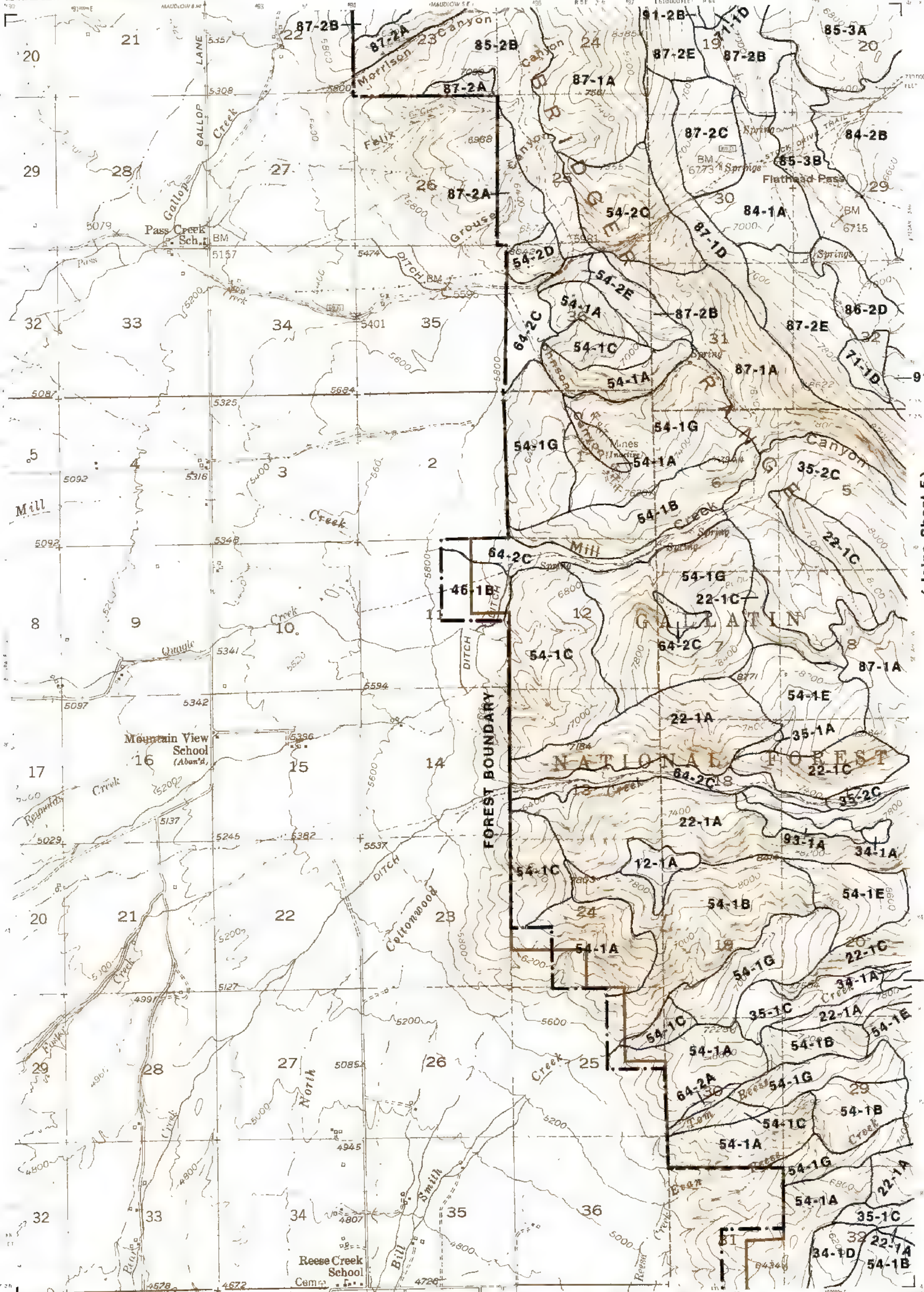
SHEET NUMBER 4
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BELGRADE N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 3)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 5)

(Joins Sheet 10)

Base map prepared by the U.S. Geological Survey
Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BELGRADE N.E., MONTANA
N4552.5—W11100/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 5
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

SEDAN N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 2)

(Joins Sheet 4)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 6)

(Joins Sheet 9)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

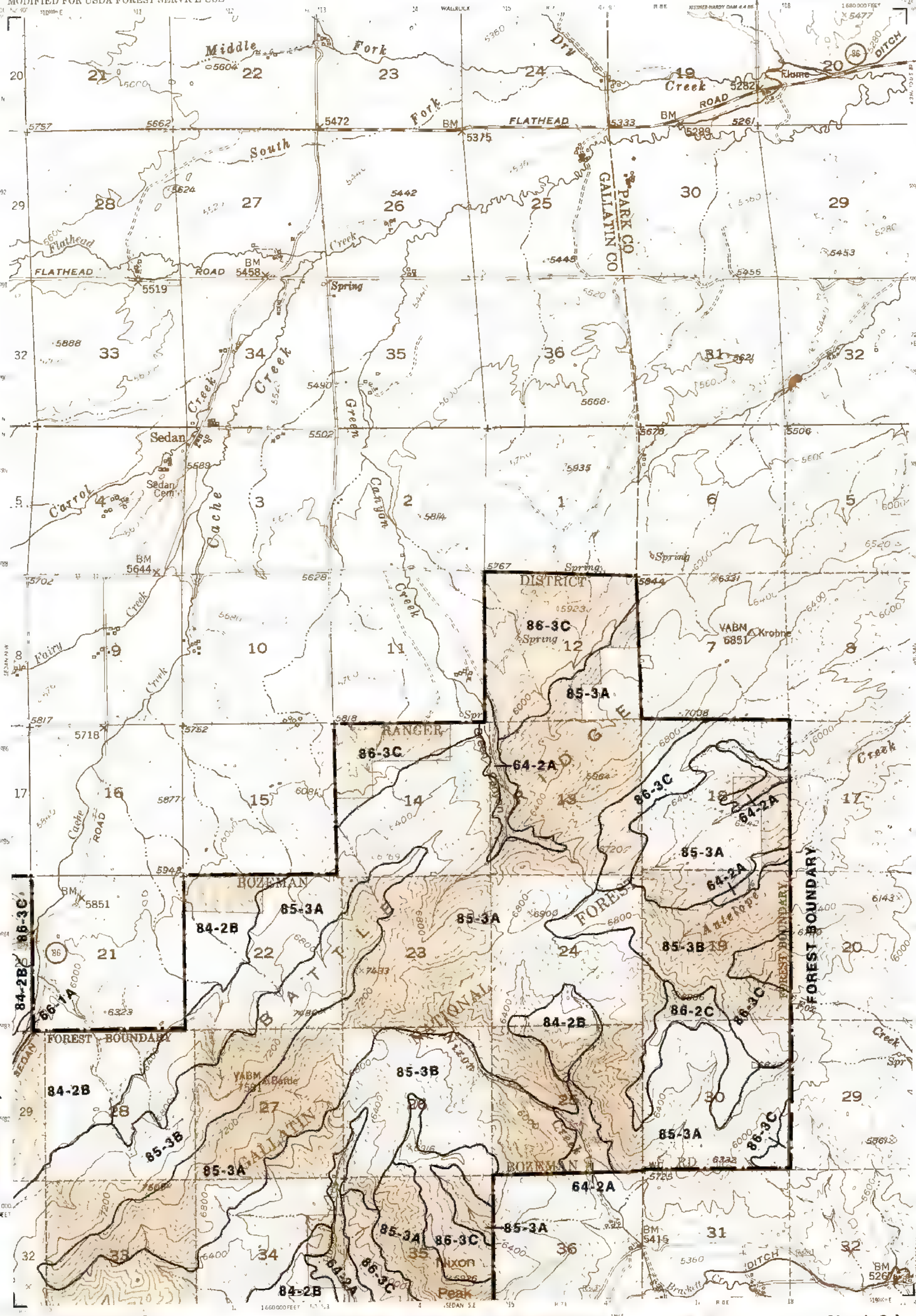
GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

SEDAN N.W., MONTANA
N4552.5—W11052.5/7.5
1951

SHEET NUMBER 6
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SEDAN N E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES



This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U S Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

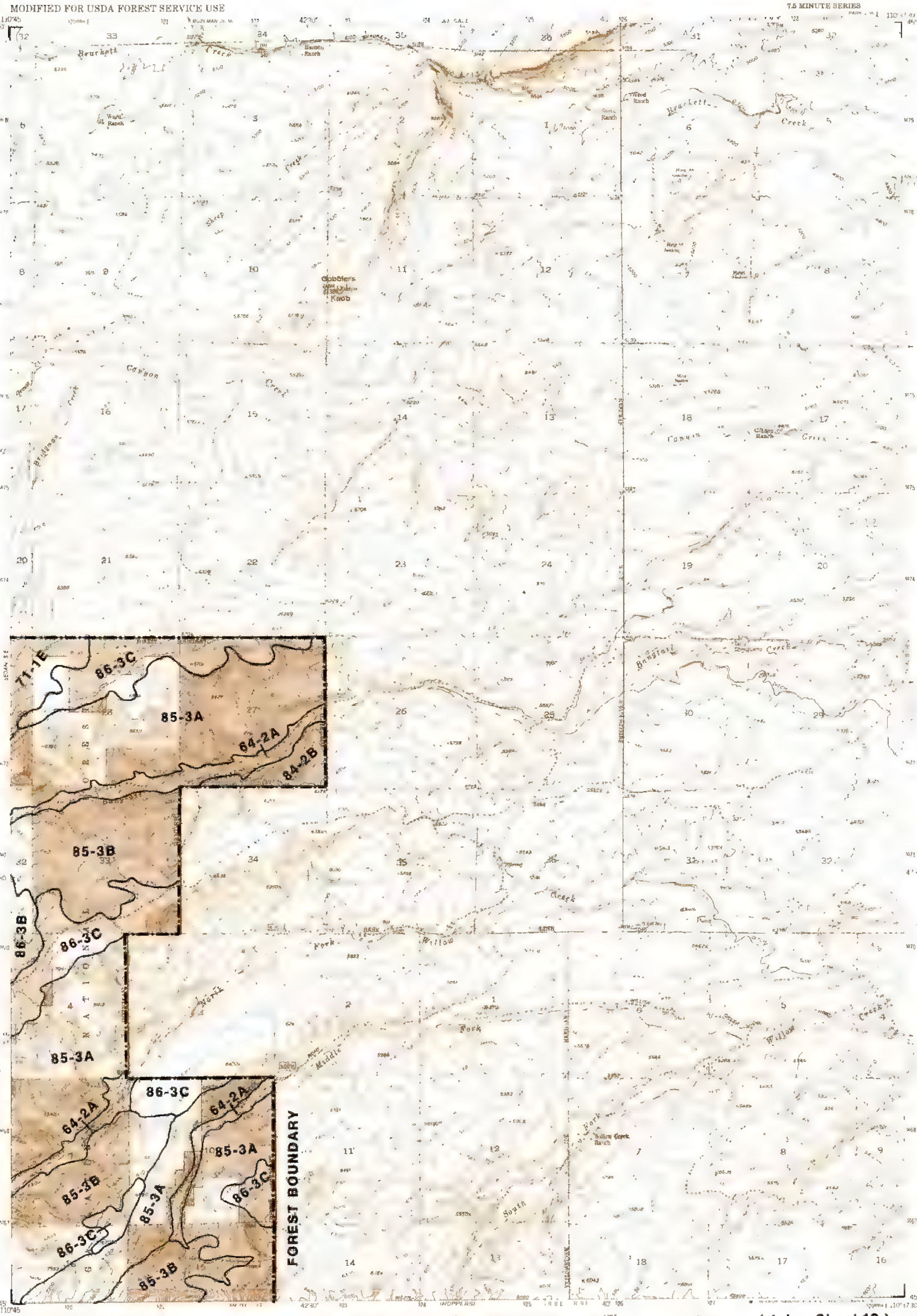
SEDAN N.E., MONTANA
N4552.5—W11045/7.5
1951

SHEET NUMBER 7
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

GOBBLERS KNOB QUADRANGLE
MONTANA PARK CO
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 13)

Base map prepared by the U S Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1948 Field check 1951

Polyconic projection 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GOBBLERS KNOB, MONT
N4545 W11037.5/7.5
1951
DMA 3875 I SW SERIES V894

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 8
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

SEDAN S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 6)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 12)

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

SEDAN S.E., MONTANA
N4545—W11045/7.5
1951

SHEET NUMBER 9
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SEDAN S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 5)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 10)

(Joins Sheet 8)

(Joins Sheet 11)

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

SEDAN S.W. MONTANA
N4545 W11052.5/7.5
1951

SHEET NUMBER 10
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BELGRADE S E QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 4)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 9)

Base map prepared by the U.S. Geological Survey

Stereo compilation by Fairchild Aerial Surveys, Inc for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947
Field check 1948-1950

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone
1000 meter Universal Transverse Mercator grid ticks, zone 12

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U S Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BELGRADE S.E., MONTANA
N4545 W11100/7.5
1950

SHEET NUMBER 11
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BOZEMAN PASS N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 9)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

All mines are inactive

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BOZEMAN PASS N.W., MONT.
N4537.5—W11052.5/7.5

1951

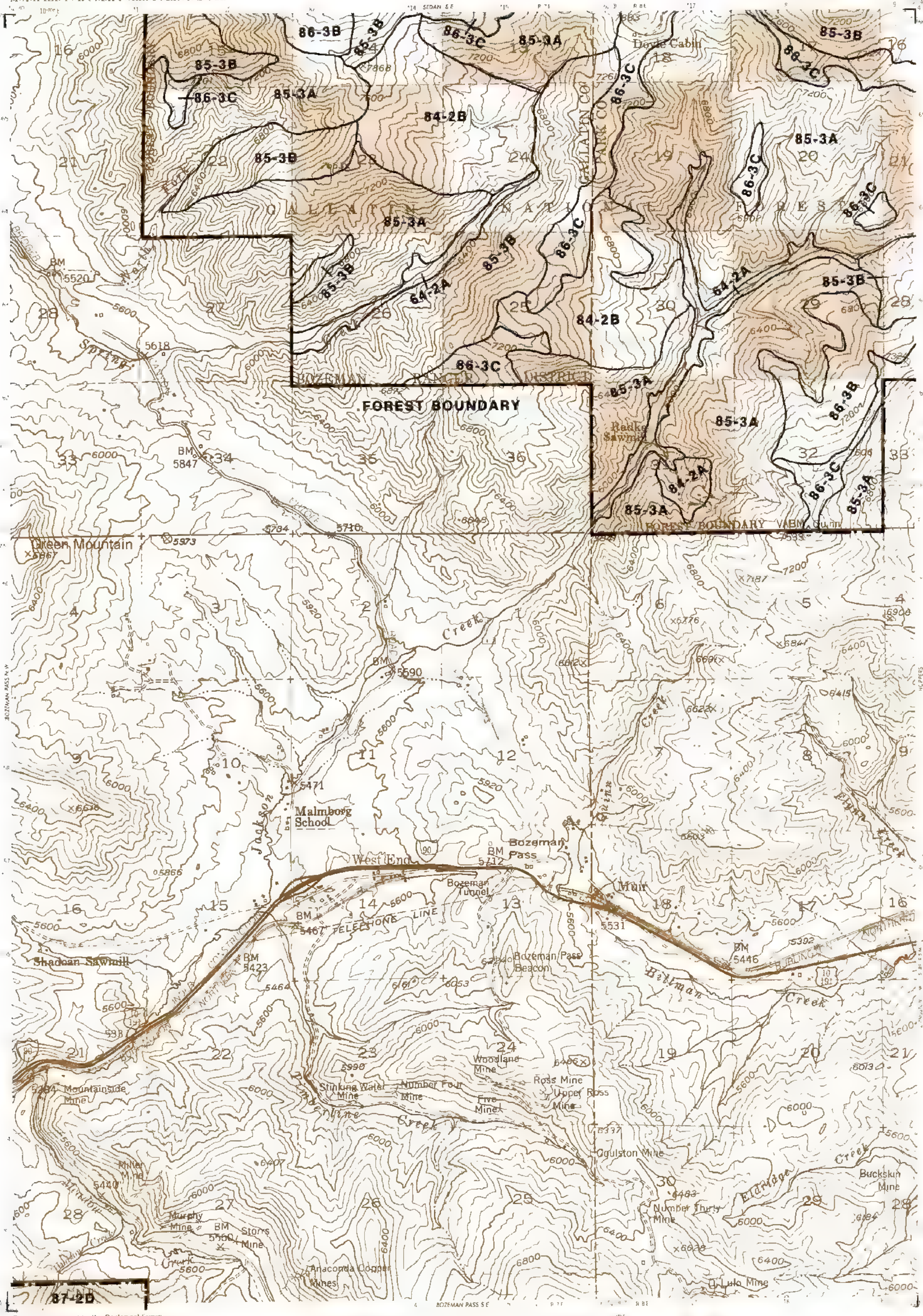
SHEET NUMBER 12
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BOZEMAN PASS N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 8)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins 11)

(Joins Sheet 13)

(Joins Sheet 75A)

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

All mines are inactive

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, B.M Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BOZEMAN PASS N.E., MONT.
N4537.5—W11045/7.5

1951

SHEET NUMBER 13
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

HOPPERS QUADRANGLE
MONTANA PARK CO.
7.5 MINUTE SERIES

(Joins Sheet 7)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods by Ryal Engineering Co. Aerial photographs taken 1948 Field check 1951

Polyconic projection. 1927 North American datum 10,000 foot grid based on Montana coordinate system south zone

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1976

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

HOPPERS, MONT.
N4537.5—W11037.5/7.5
1951

SHEET NUMBER 14
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

RIMROCK DIVIDE QUADRANGLE
MONTANA MEAGHER CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 16)

Base map prepared by the Geological Survey and the Bureau of Reclamation
Edited and published by the Geological Survey for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereophotogrammetric methods 1947-1950 Aerial photographs taken 1947
Field check 1948-1951

Polyconic projection 1927 North American datum
10,000 foot grid based on Montana coordinate system, central zone

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

RIMROCK DIVIDE, MONTANA
N4615-W11030/7.5
1951

SHEET NUMBER 15
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

LEBO QUADRANGLE
MONTANA MEAGHER CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 14)

(Joins Sheet 17)

Base map prepared by the U.S. Geological Survey

Control by USGS and NOS NOAA

Topography by photogrammetric methods from aerial photographs taken 1971 Field checked 1972

Projection and 10,000 foot grid ticks Montana coordinate system central zone (Lambert conformal conic) 1000 metre Universal Transverse Mercator grid ticks zone 12, shown in blue 1927 North American datum

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

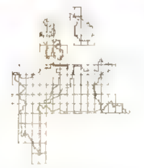
- Wilderness Boundary
- National Forest Boundary
- Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Unreliable
- Unsurveyed BLM Protraction

- Primary Highway
- Secondary Highway
- Light Duty Road
- Primitive Road
- Trail

- Interstate
- U.S. Highway
- State Highway
- County Highway
- Forest Road
- 566 Forest Trail



GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

LEBO, MONT.
N4615 W11022.5/7.5

1972

DMA 3976 IV SW SERIES V894

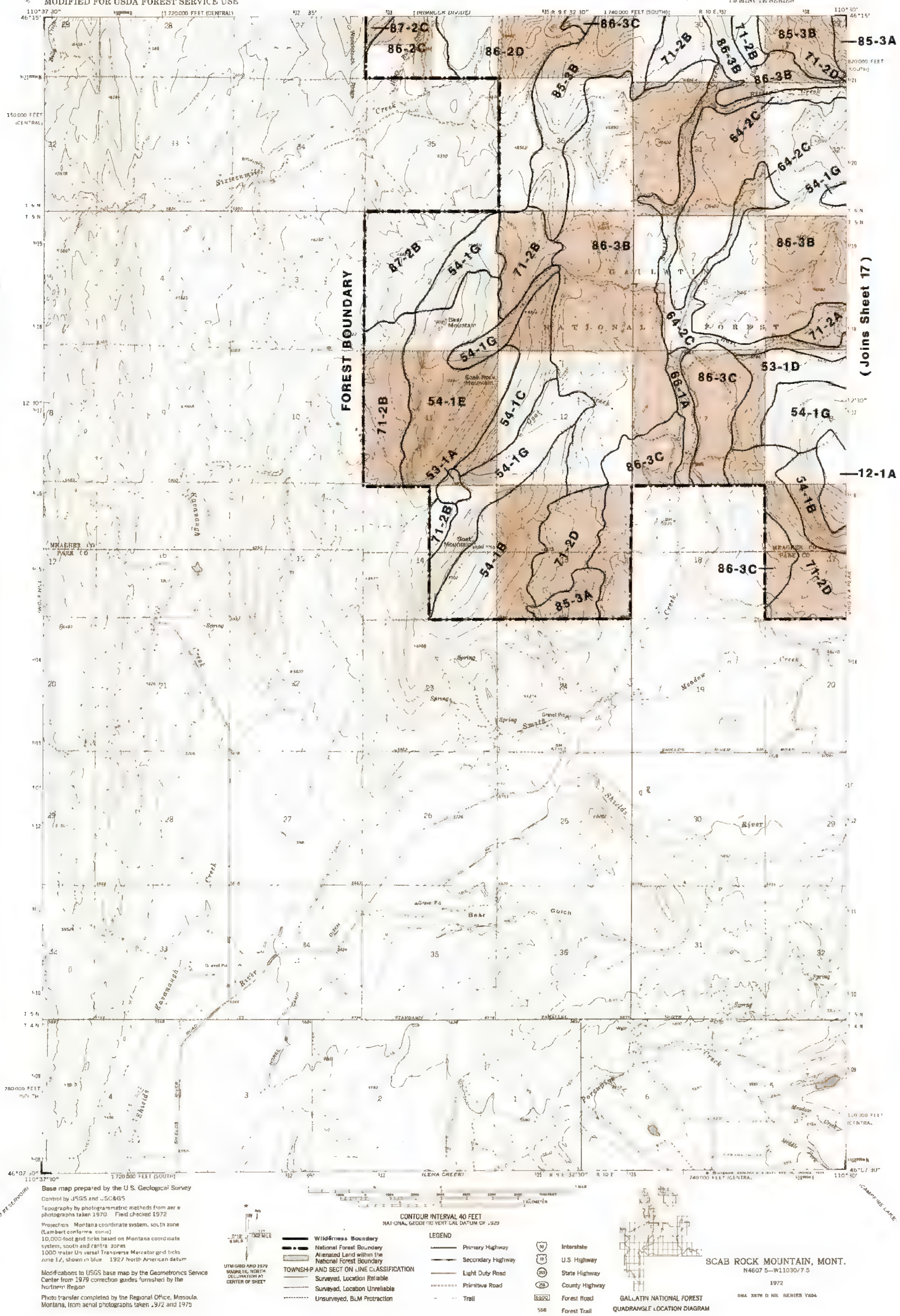
SHEET NUMBER 16
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 14)

SCAB ROCK MOUNTAIN QUADRANGLE
MONTANA
7.5 MINUTE SERIES

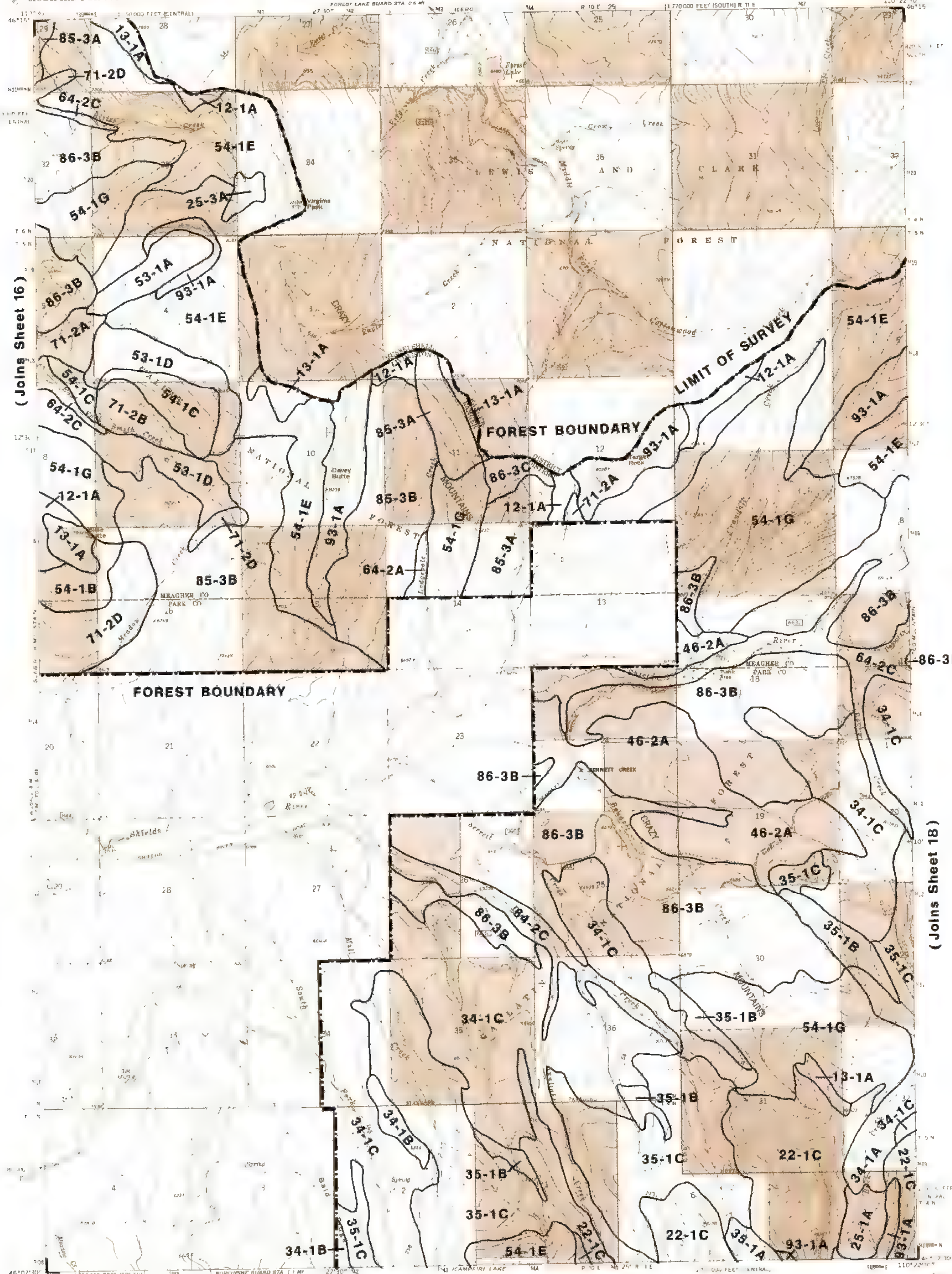
This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



SHEET NUMBER 17
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

VIRGINIA PEAK QUADRANGLE
MONTANA
7.5 MINUTE SERIES



This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1970. Field checked 1972

Projection: Montana coordinate system, south zone (Lambert conformal conic)
10,000-foot grid ticks based on Montana coordinate system, south and central zones
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue. 1927 North American datum

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

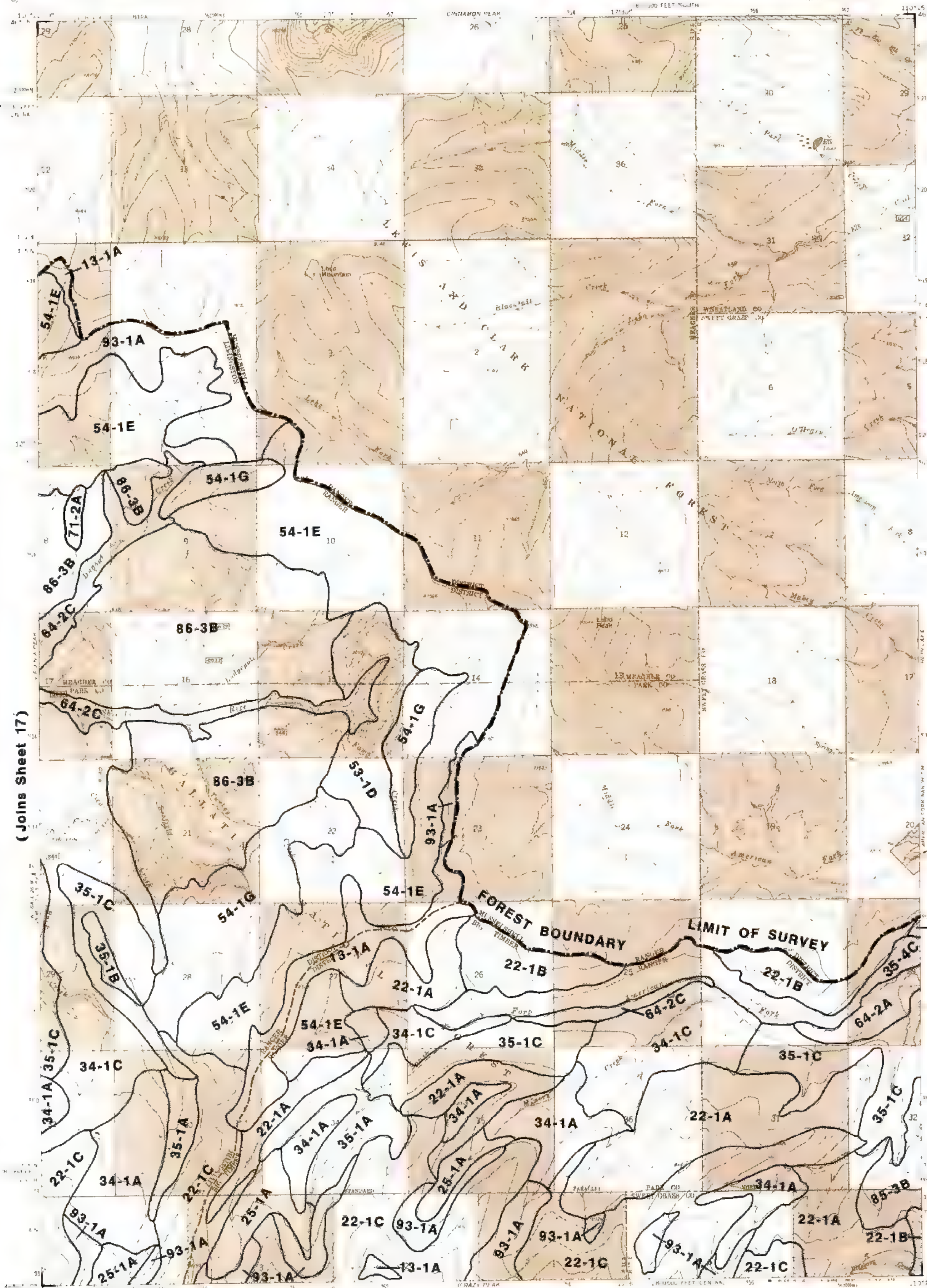
VIRGINIA PEAK, MONT.
N4607.5—W11022.5/7.5
1972
DMA 3976 NW—SERIES V894

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 18
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

LOCO MOUNTAIN QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 21)

Base map prepared by the U.S. Geological Survey
Control by USGS and NOS/NOAA

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

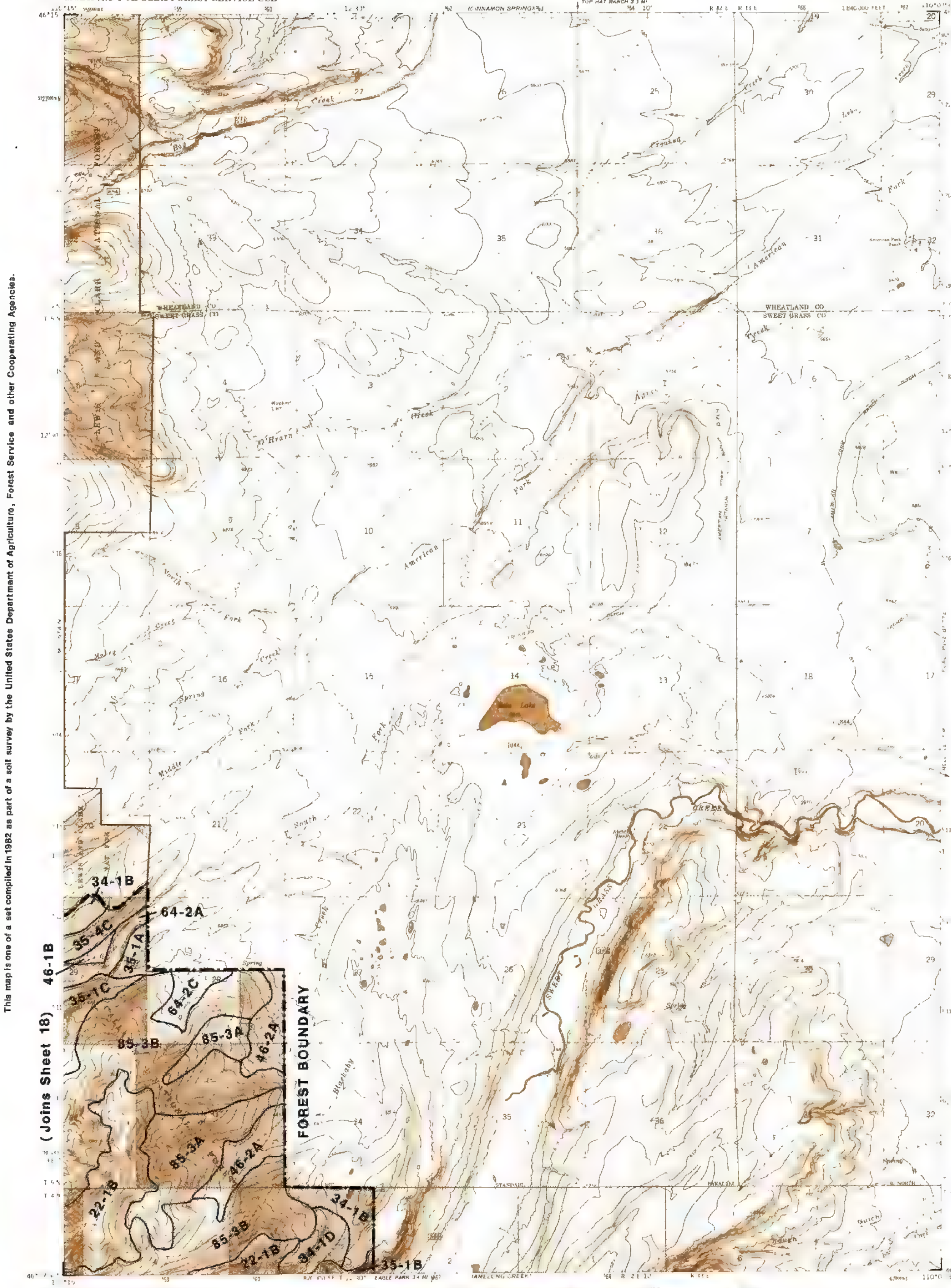
GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

LOCO MOUNTAIN, MONT.

SHEET NUMBER 19
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

REIN LAKE QUADRANGLE
MONTANA
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway		Interstate	
Secondary Highway		U.S. Highway	
Light Duty Road		State Highway	
Primitive Road		County Highway	
Trail		Forest Road	
		Forest Trail	

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

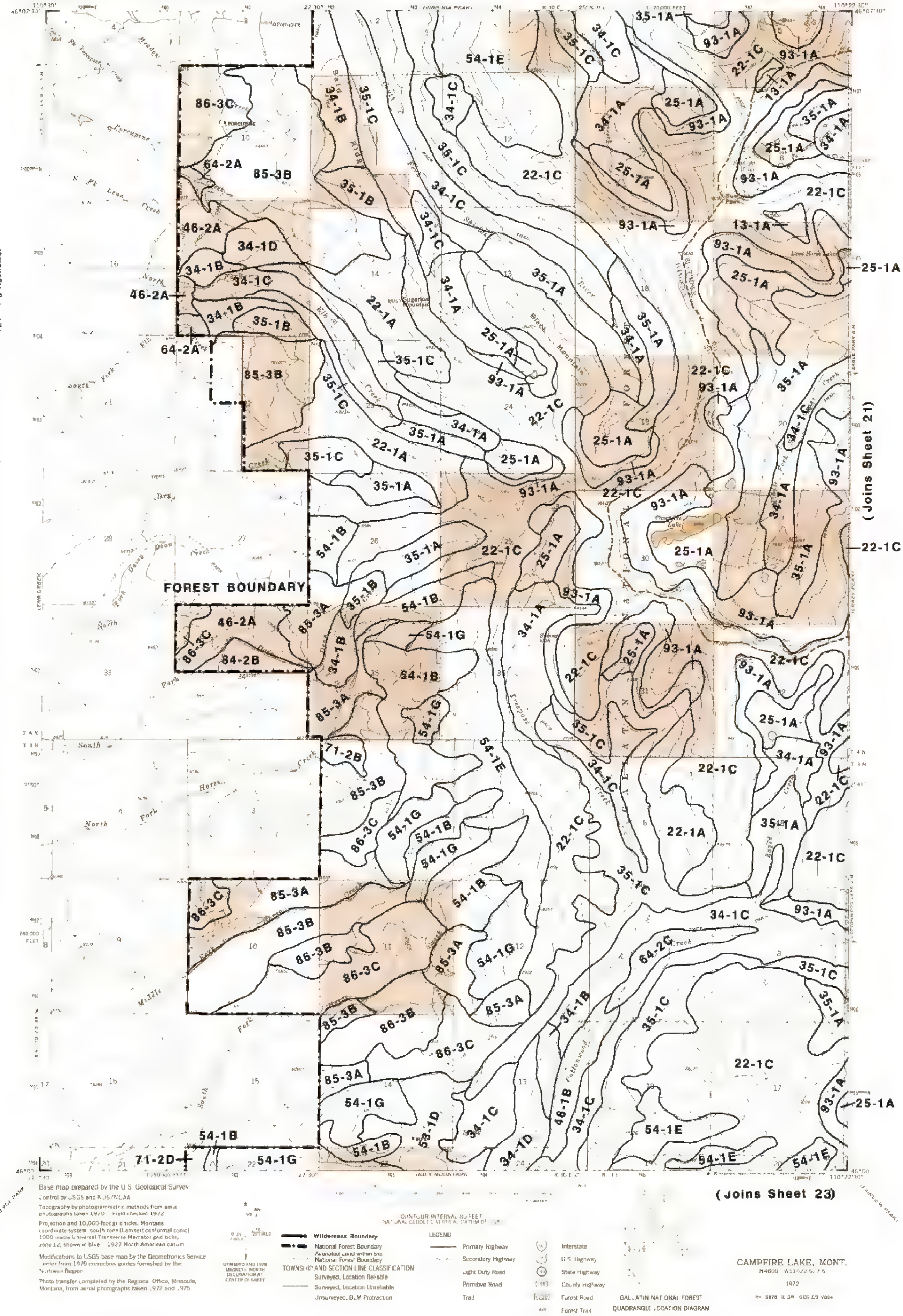
REIN LAKE, MONT.
N4607.5—W11007.5/7.5
1972

SHEET NUMBER 20
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

CAMPFIRE LAKE QUADRANGLE
MONTANA—PARK CO.

(Joins Sheet 17)



(Joins Sheet 21)

(Joins Sheet 23)

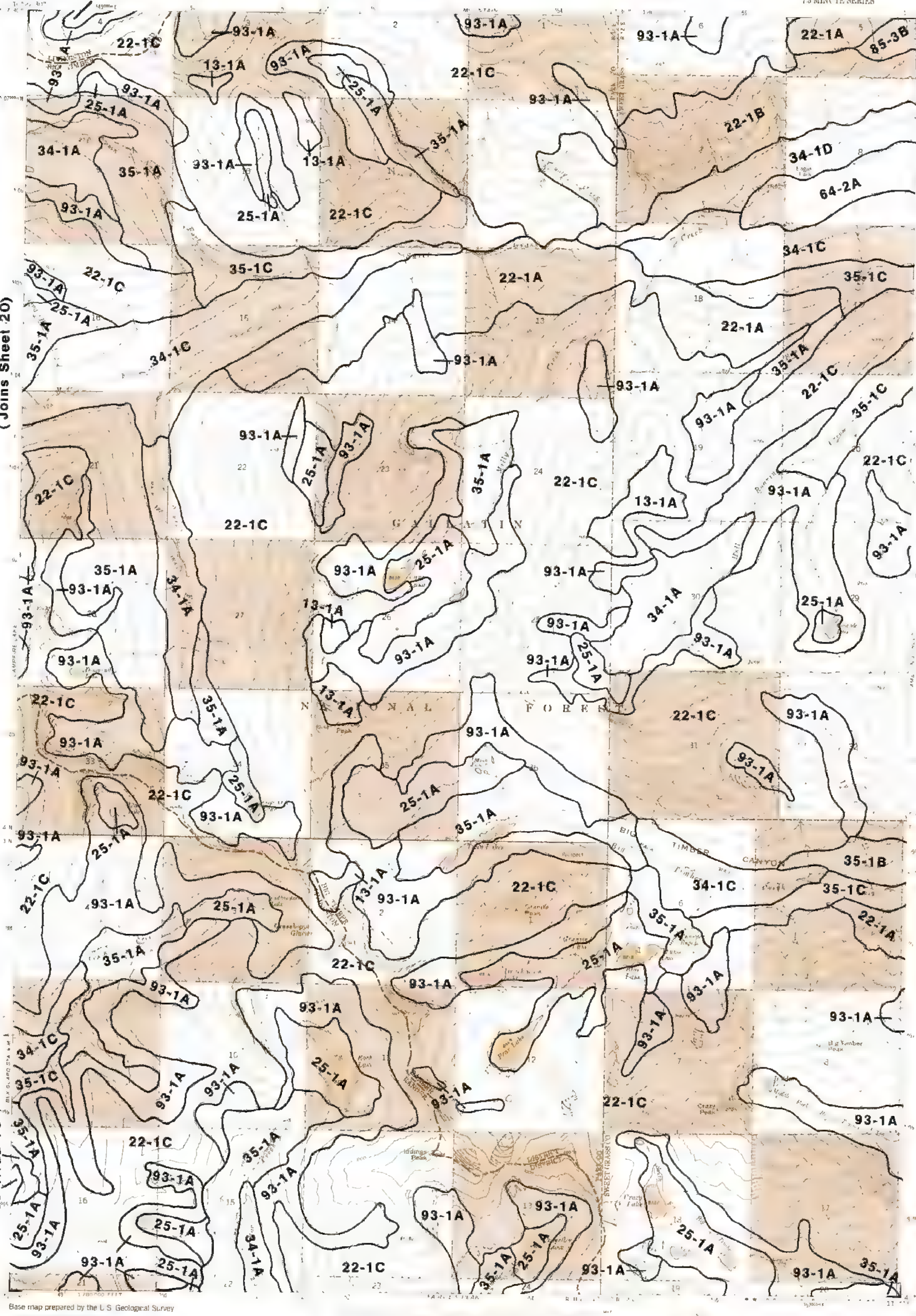
CAMPFIRE LAKE, MONT.
1972

SHEET NUMBER 21
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CRAZY PEAK QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 18)



(Joins Sheet 20)

(Joins Sheet 22)

(Joins Sheet 24)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey

Modified from 1:24,000 scale base map by the Geometronics Service Center from 1979. Correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office, Missoula Montana, from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCAT ON DIAGRAM

CRAZY PEAK, MONT.
N4600 W11015/7.5
1972

SHEET NUMBER 22
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 19)

AMELONG CREEK QUADRANGLE
MONTANA–SWEET GRASS CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 21)

(Joins Sheet 25)

Base map prepared by the U.S. Geological Survey
Topography by photogrammetric methods from aerial photographs taken 1970. Field checked 1972
Projection and 10,000 foot grid ticks: Montana coordinate system, south zone (Lambert conformal conic)
1000 metre Universal Transverse Mercator grid ticks, zone 12, shown in blue. 1927 North American datum
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

AMELONG CREEK, MONT.
N4600—W11007.5/7.5
1972

SHEET NUMBER 23
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 20)

IBEX MOUNTAIN QUADRANGLE
MONTANA-PARK CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Topography from aerial photographs by multiplex methods. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

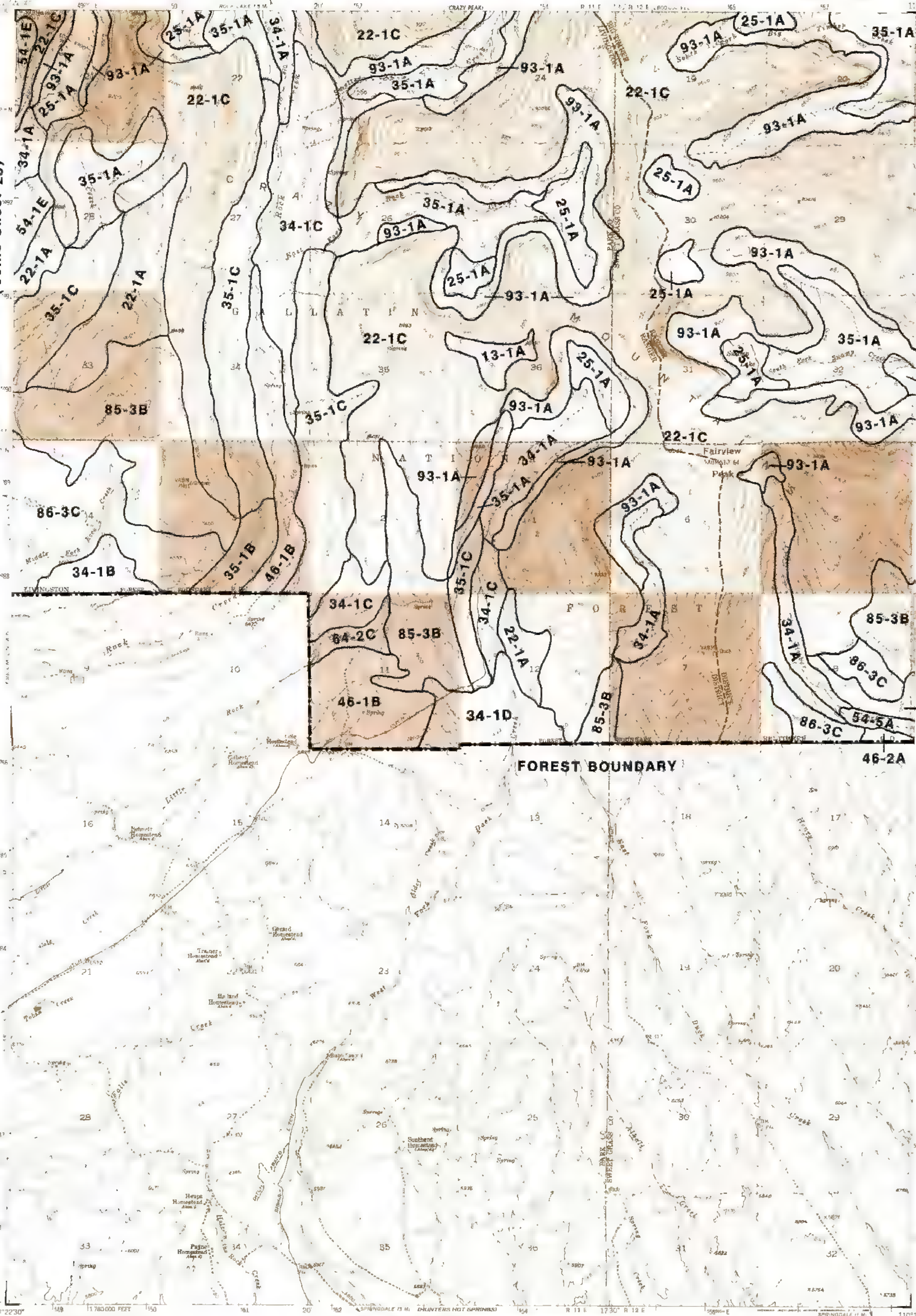
IBEX MOUNTAIN, MONT
N4552.5-W11022.5/7.5
1951

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 24
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

(Joins Sheet 21)

FAIRVIEW PEAK QUADRANGLE
MONTANA
7.5 MINUTE SERIES



This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods by Tennessee Valley Authority. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

FAIRVIEW PEAK, MONT.
N4552.5—W11015/7.5
1951

SHEET NUMBER 25
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

RASPBERRY BUTTE QUADRANGLE
MONTANA SWEET GRASS CO.
7.5 MINUTE SERIES

(Joins Sheet 22)

(Joins Sheet 24)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1948 Field check 1951

Polyconic projection 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

RASPBERRY BUTTE, MONT.
N4552.5—W11007.5/7.5
1951

SHEET NUMBER 26
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MC LEOD QUADRANGLE
MONTANA-SWEET GRASS CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 33)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MC LEOD, MONT.
N4537.5—W11000/7.5
1951

SHEET NUMBER 27
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

ROSS CANYON QUADRANGLE
MONTANA-SWEET GRASS CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 26)

(Joins Sheet 28)

(Joins Sheet 34)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Aerial photographs taken 1951. Field check 1954

Polyconic projection. 1927 North American datum

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

ROSS CANYON, MONT.
1954

509-2-3-2

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 28
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

PACKSADDLE BUTTE QUADRANGLE
MONTANA–SWEET GRASS CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 35)

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1951. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20 FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

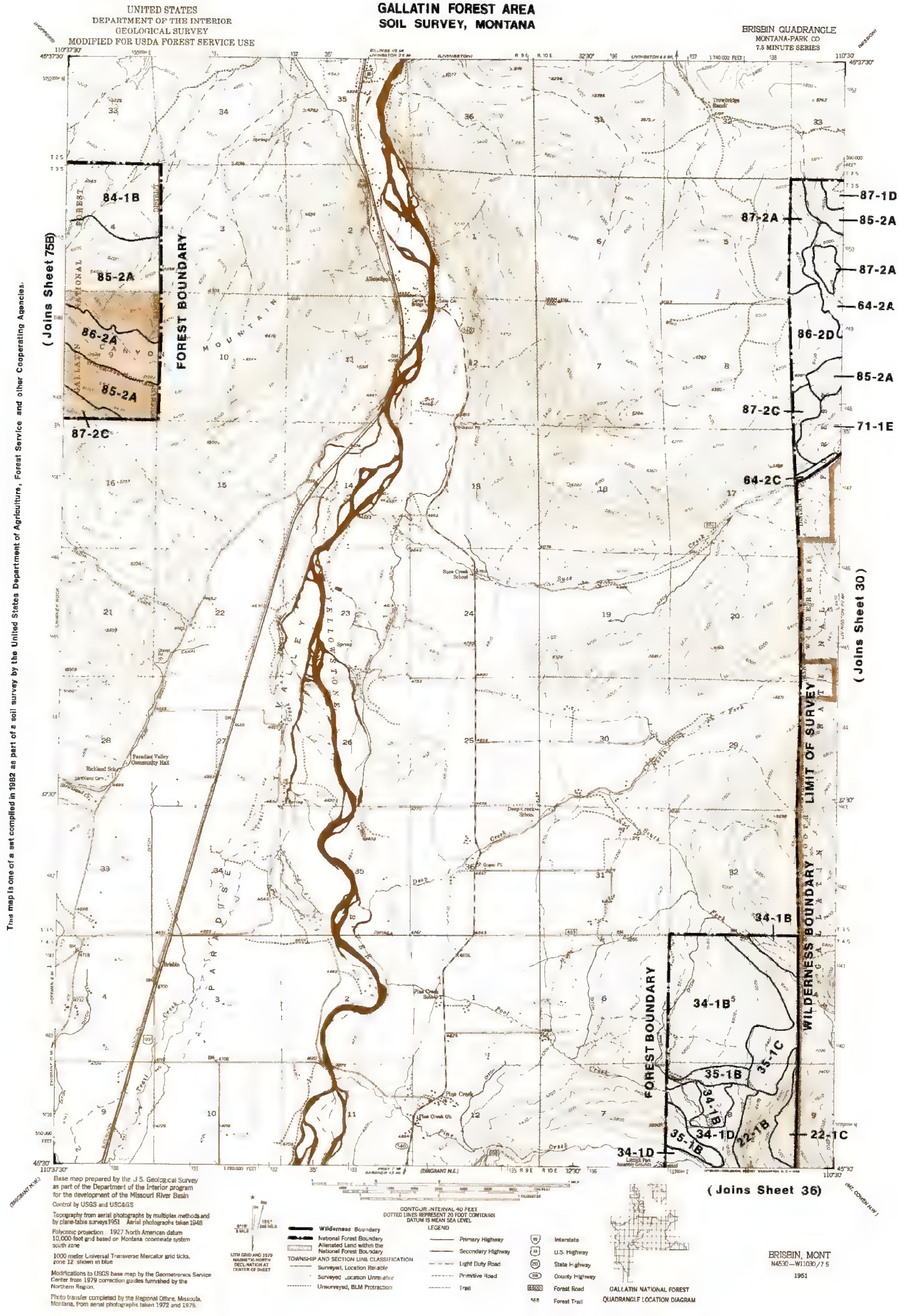
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

PACKSADDLE BUTTE, MONT.
N4537.5—W10945/7.5
1955

509-2-3-1

SHEET NUMBER 29
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA



SHEET NUMBER 30
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

LIVINGSTON PEAK QUADRANGLE
MONTANA PARK CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 29)

(Joins Sheet 31)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary

Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

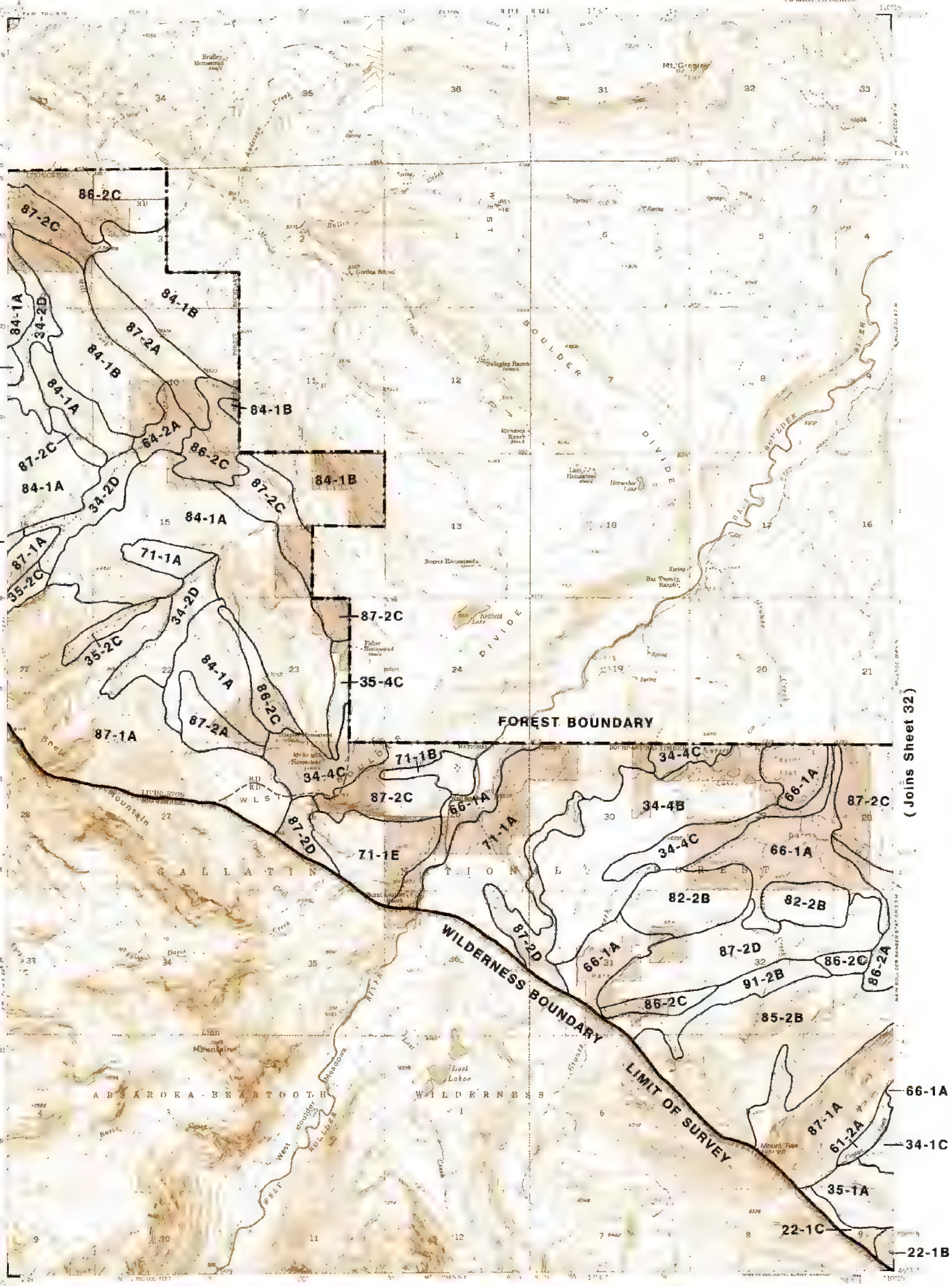
LIVINGSTON PEAK, MONT.
N4530 — W11022.5/7.5
1951

SHEET NUMBER 31
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT RAE QUADRANGLE
MONTANA-PARK CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods by the Geological Survey and Tennessee Valley Authority. Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum. 10,000-foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary

Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION

Surveyed, Location Reliable

Surveyed, Location Unreliable

Unsurveyed, BLM Protraction

LEGEND

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT RAE, MONT.
N4530-W11015/7.5
1951

SHEET NUMBER 32
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MC LEOD BASIN QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

110°15′ 1 610 000 FEET FOURMILE RANGER STATION 13 MI. 12′30″ R 12 E (MT DOUGLAS N.W.) 10′ R 13 E 45°30′ 110°07′30″

(Joins Sheet 39)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods by the Tennessee Valley Authority 1951
Aerial photographs taken 1948 Field check 1951

Polyconic projection 1927 North American datum
10 000-foot grid based on Montana coordinate system south zone

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary

Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

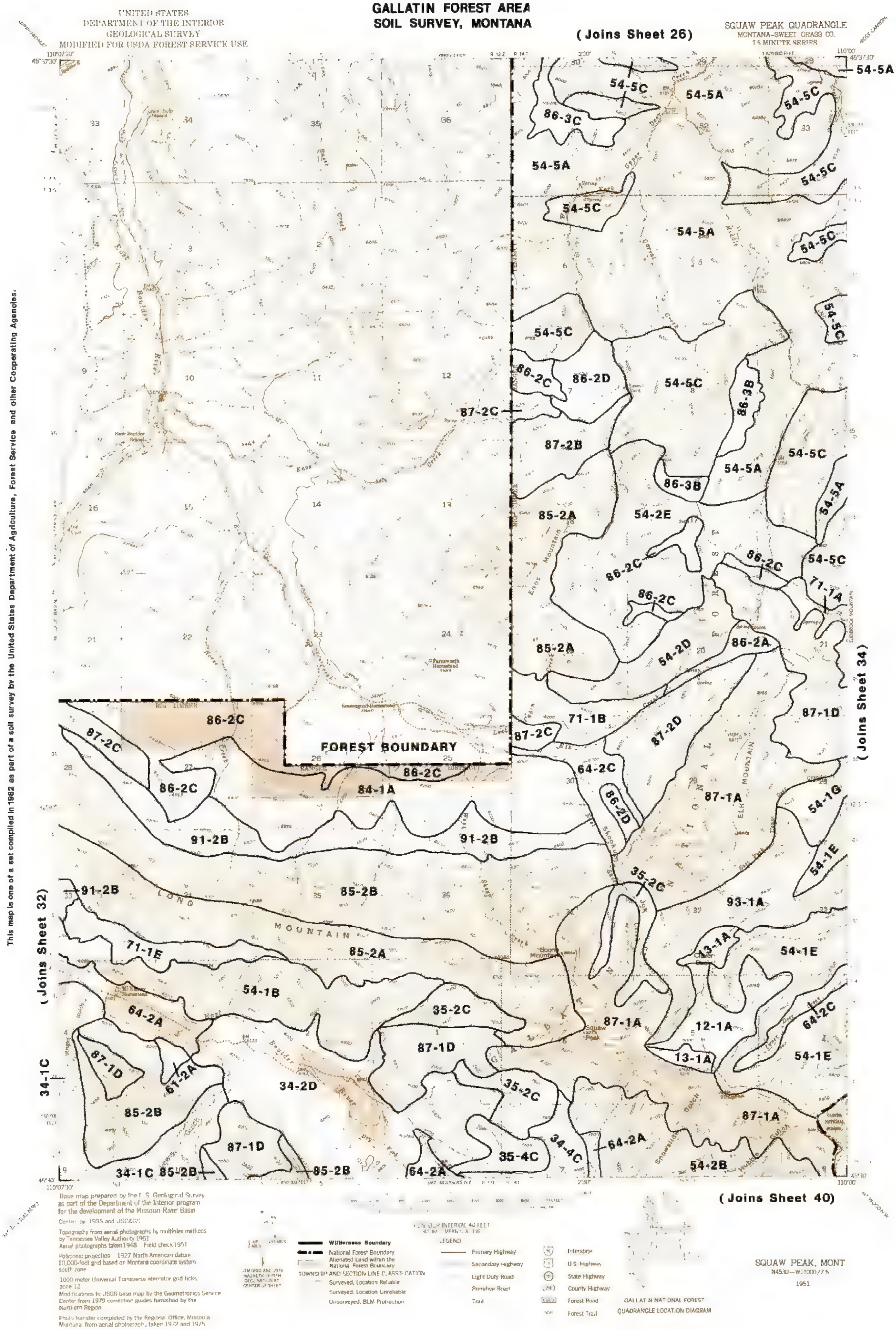
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MC LEOD BASIN, MONT.
N4530—W11007.5/7.5
1951

SHEET NUMBER 33
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA



SHEET NUMBER 34
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SLIDEROCK MOUNTAIN QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 27)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

SHEET NUMBER 35
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 28)

WILDCAT DRAW QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 34)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1951. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

- Wilderness Boundary
- National Forest Boundary
- Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Unreliable
- Unsurveyed, BLM Protraction

- Primary Highway
- Secondary Highway
- Light Duty Road
- Primitive Road
- Trail

- Interstate
- U.S. Highway
- State Highway
- County Highway
- Forest Road
- Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

WILDCAT DRAW, MONT.
N4530—W10945/7.5
1955
DMA 4075 II SE—SERIES V893

509-2-3-4

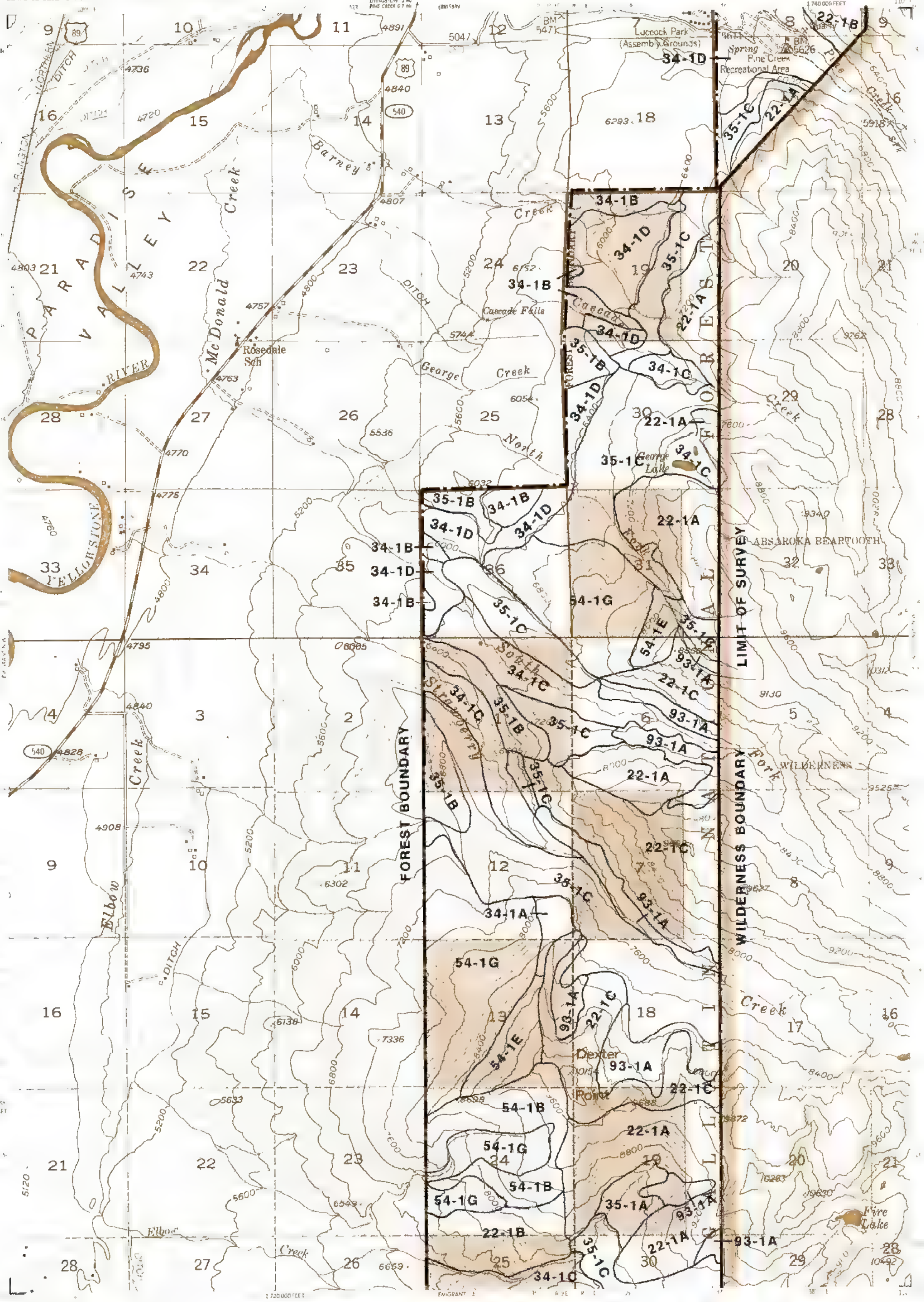
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 36
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

EMIGRANT N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 29)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 44)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks zone 12 shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

EMIGRANT N.E. MONTANA

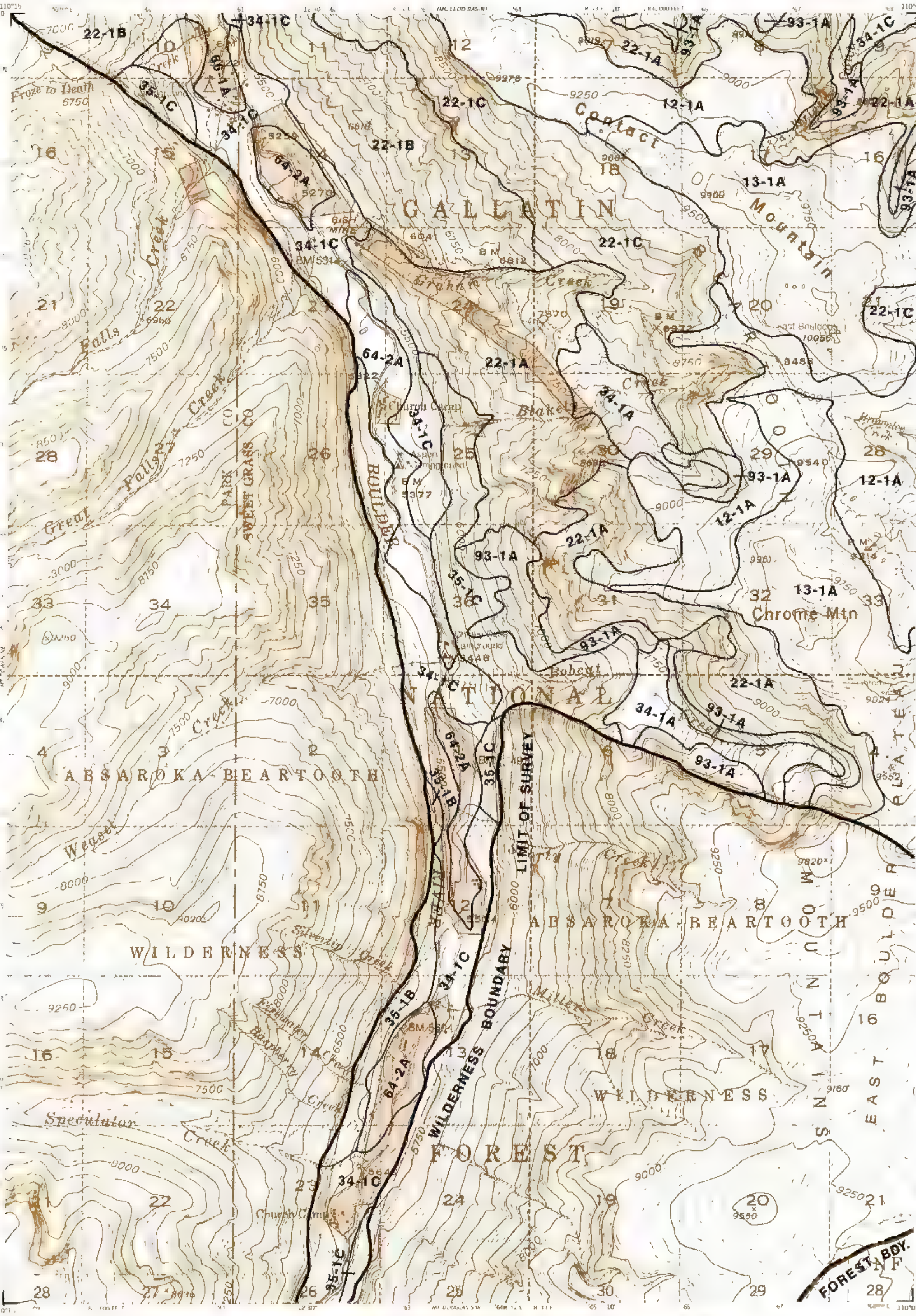
SHEET NUMBER 39
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT DOUGLAS N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 32)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 40)

(Joins Sheet 47)

Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana (South) rectangular coordinate system
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Surveyed in 1939 and 1941

Topography by J.L. Lewis and J.J. Hayes

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT DOUGLAS N.W., MONTANA
N4522.5—W11007.5/7.5
1941

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

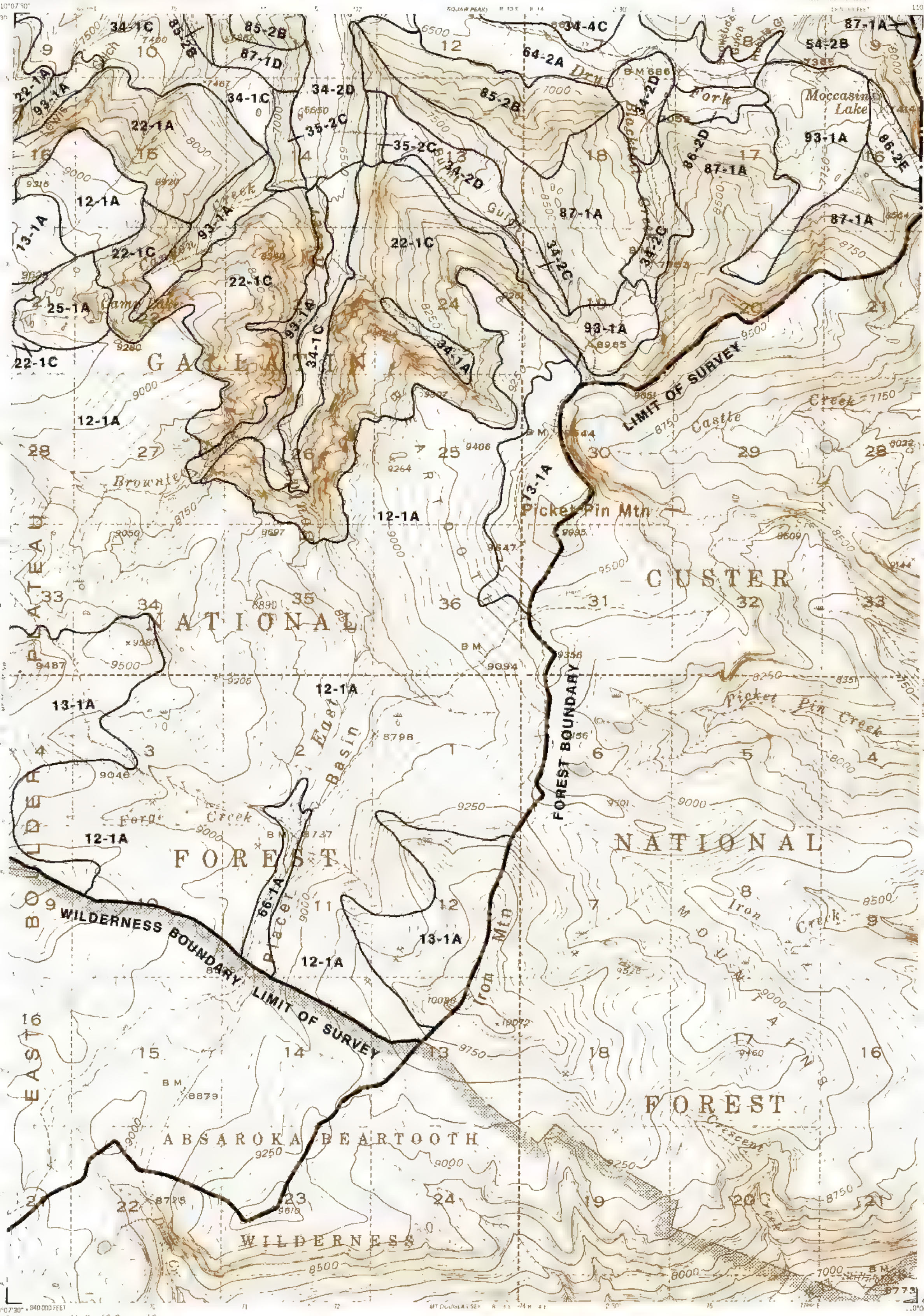
SHEET NUMBER 40
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

(Joins Sheet 33)

MOUNT DOUGLAS N.E. QUADRANGLE
MONTANA

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 39)



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana (South) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Surveyed in 1939 and 1941

Topography by J. L. Lewis and J. J. Hayes

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1976

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

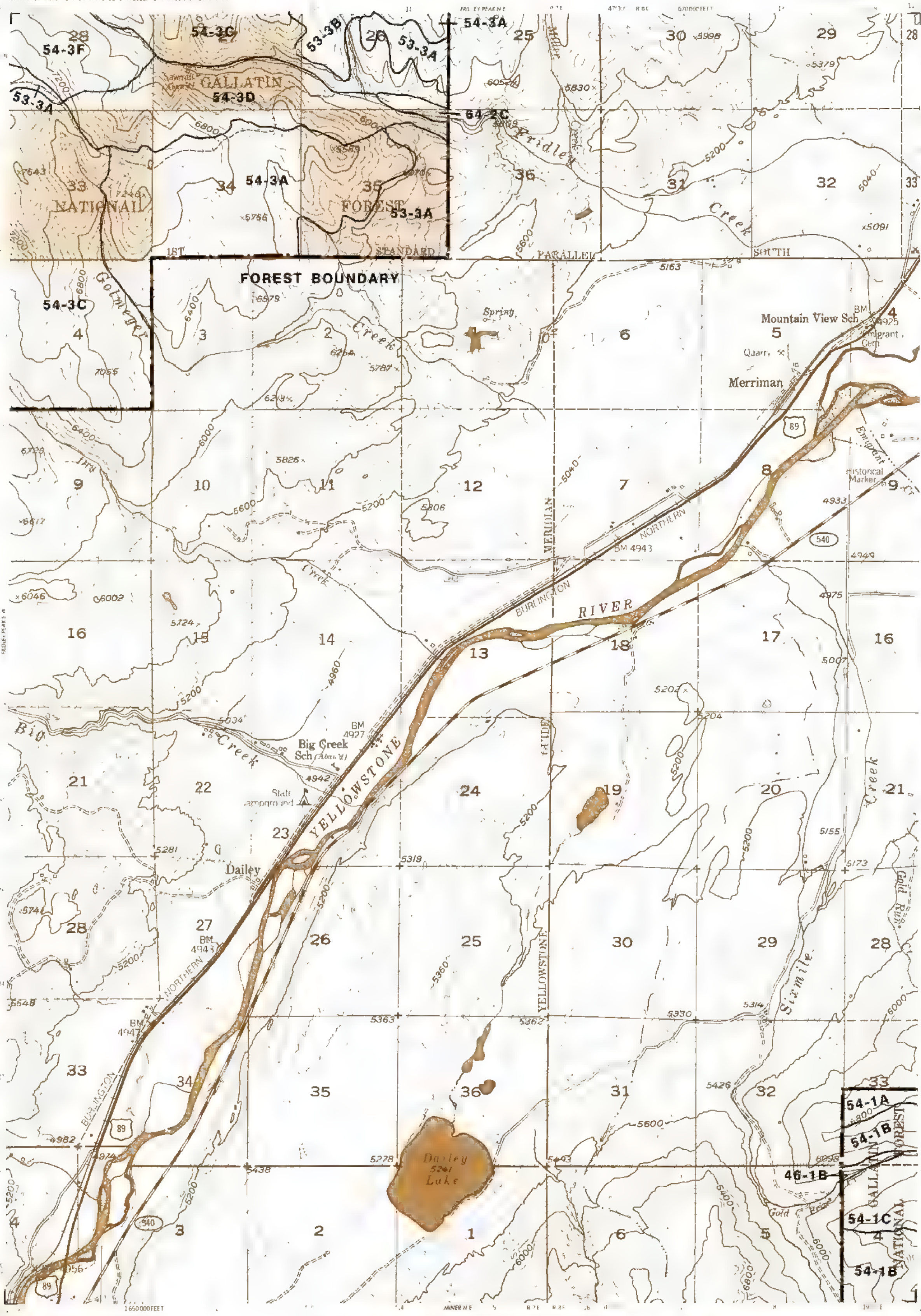
MOUNT DOUGLAS NE., MONTANA
N4522.5—W11000/7.5
1941

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 42
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

FRIDLEY PEAK S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



1650000 FEET

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system south zone

1000 meter Universal Transverse Mercator grid ticks zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 19..

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

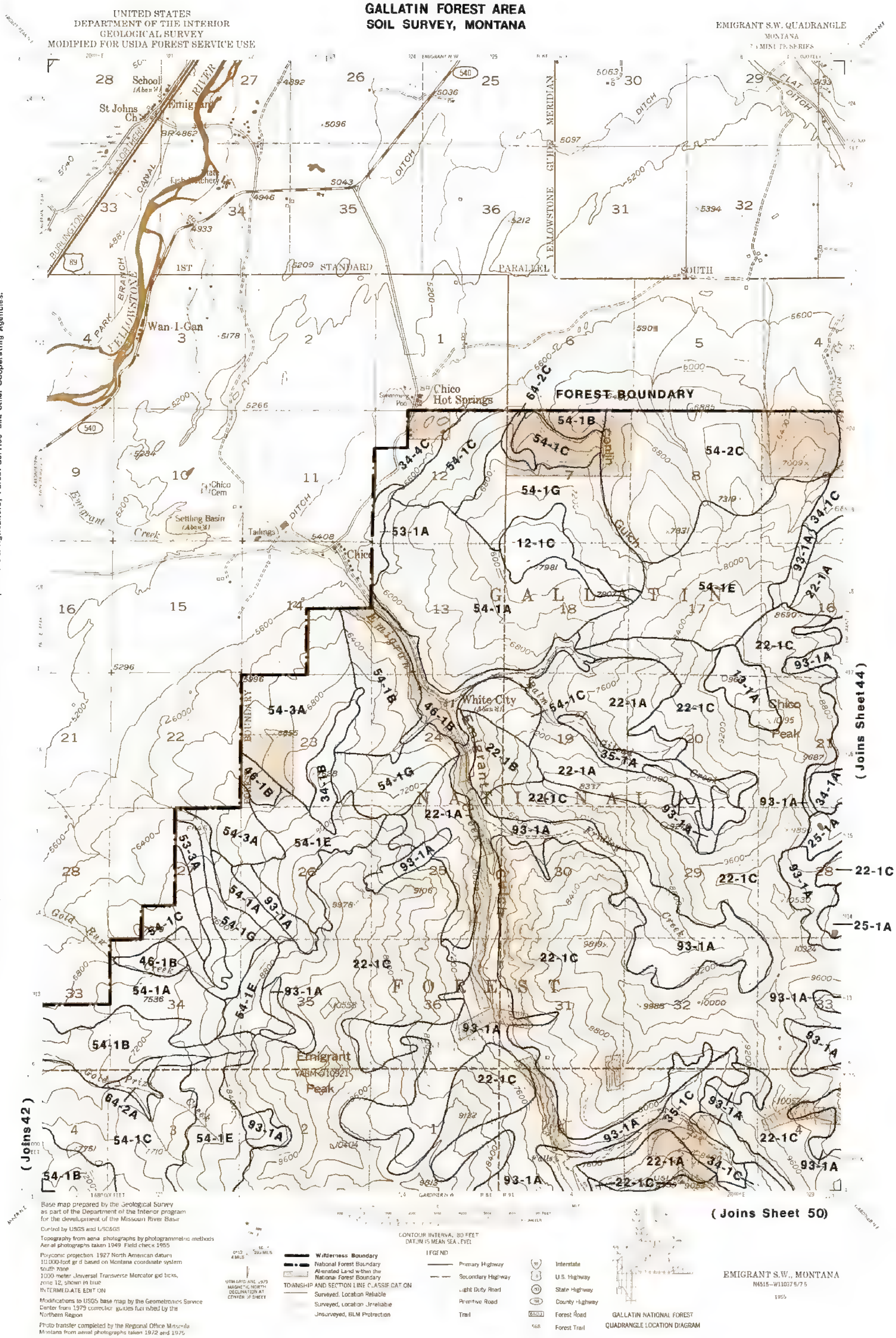
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
568 Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

FRIDLEY PEAK S.E., MONTANA
N4515—W11045/7.5
1955

SHEET NUMBER 43
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA



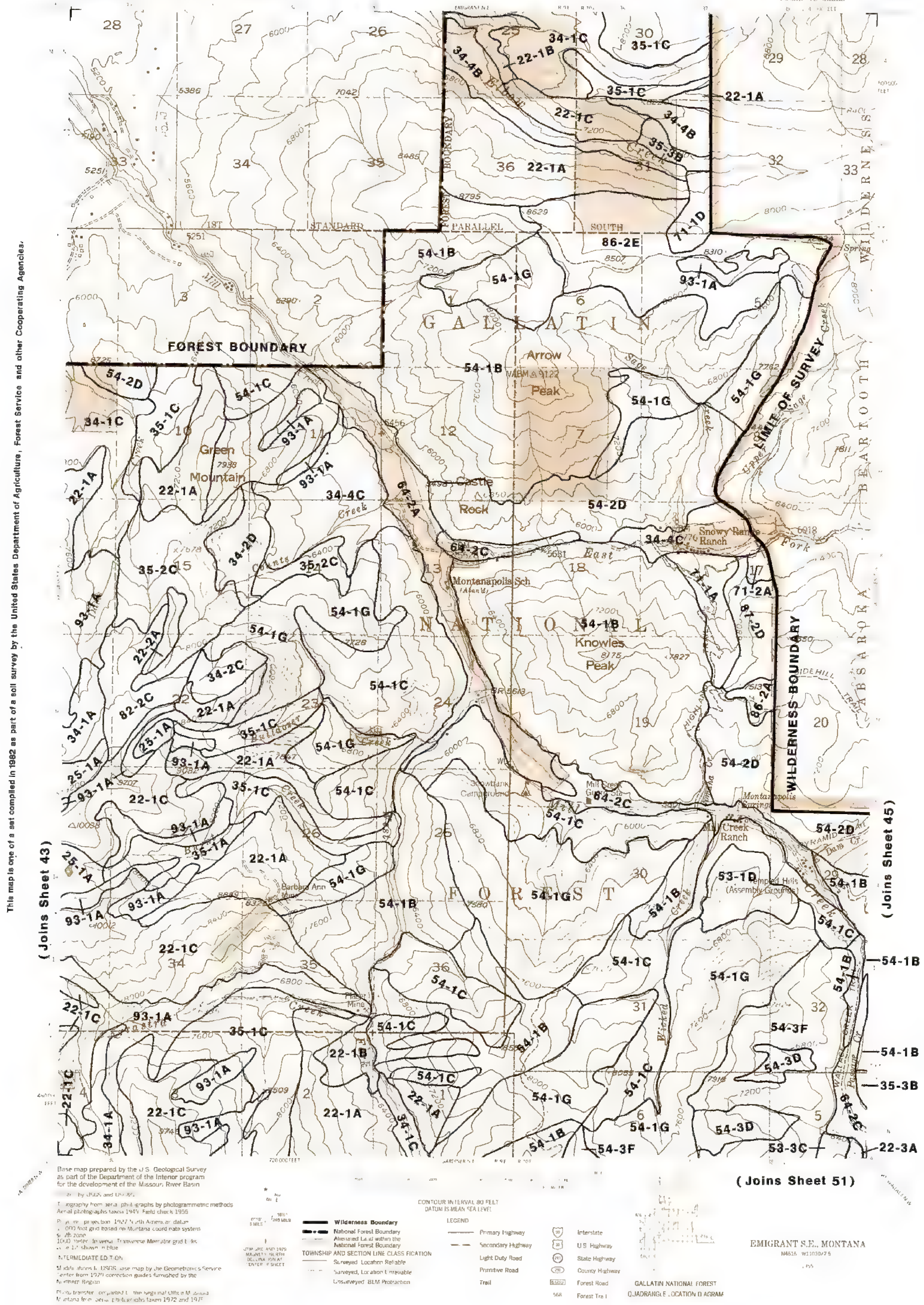
This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

SHEET NUMBER 44
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

EMIGRANT S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 36)



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 45
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

MOUNT COWEN S.W. QUADRANGLE
MONTANA

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 52)

Base map prepared by the Geological Survey
Topography by J. L. Lewis, F.H. Purdy, and J.M. Holmes
Surveyed in 1938--1940
Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana (South) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT COWEN S.W., MONTANA

SHEET NUMBER 46
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT COWEN S.E. QUADRANGLE
MONTANA

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 45)

(Joins Sheet 47)

(Joins Sheet 53)

Base map prepared by the Geological Survey
Topography by J.L. Lewis, F.H. Purdy, and J.M. Holmes
Surveyed in 1938 - 1940
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana (South) rectangular coordinate system
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT COWEN S.E., MONTANA

SHEET NUMBER 47
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT DOUGLAS S.W. QUADRANGLE

(Joins Sheet 39)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 46)

(Joins Sheet 54)

Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana (south) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks

Surveyed in 1939 and 1941

Topography by J. L. Lewis and J. J. Hayes

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT DOUGLAS S.W., MONTANA
N4515—W11007.5/7.5
1941

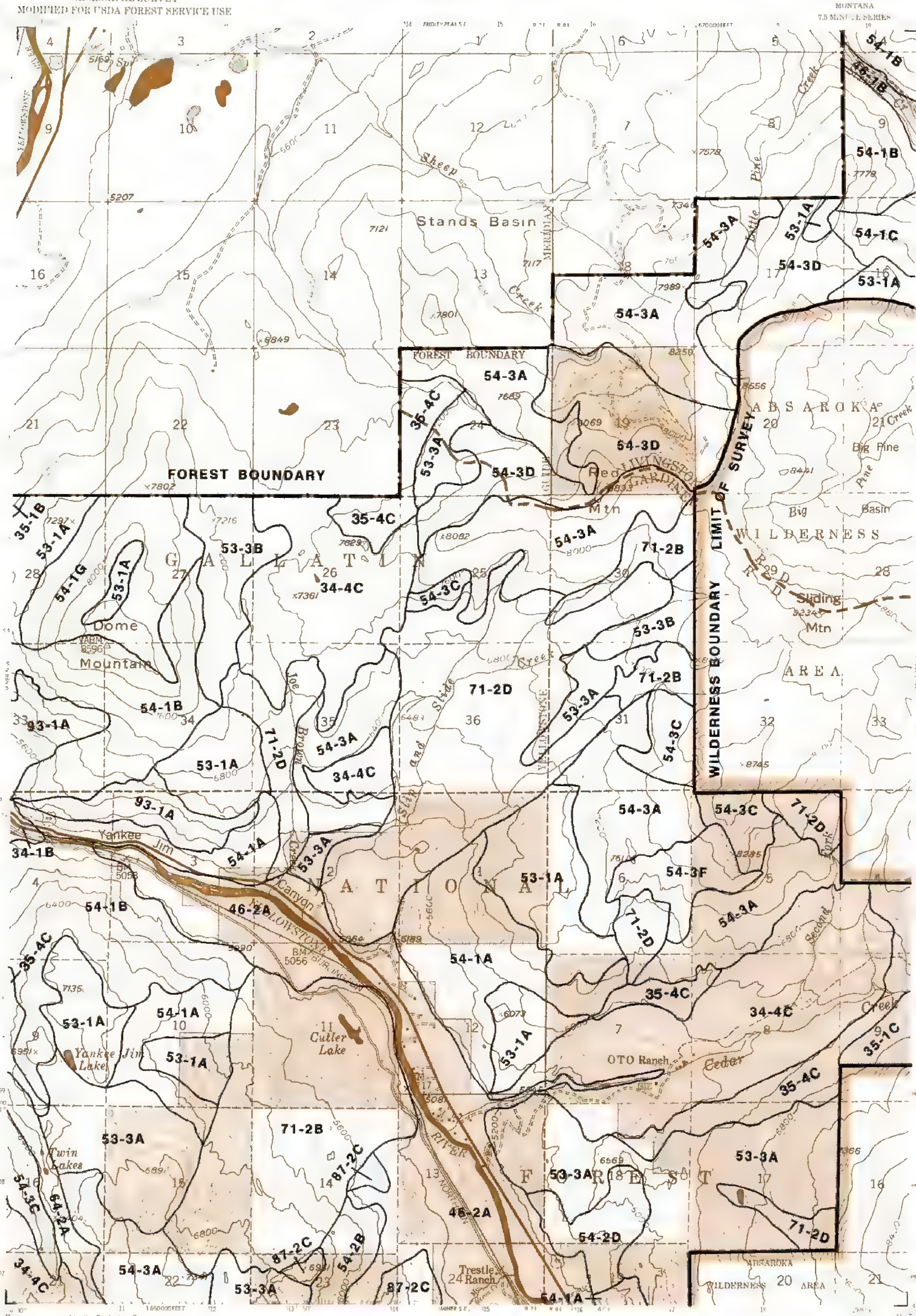
SHEET NUMBER 49
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MINER N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 95)



(Joins Sheet 50)

(Joins Sheet 58)

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1954. Aerial photographs taken 1947–1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system south zone and Wyoming coordinate system, west zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

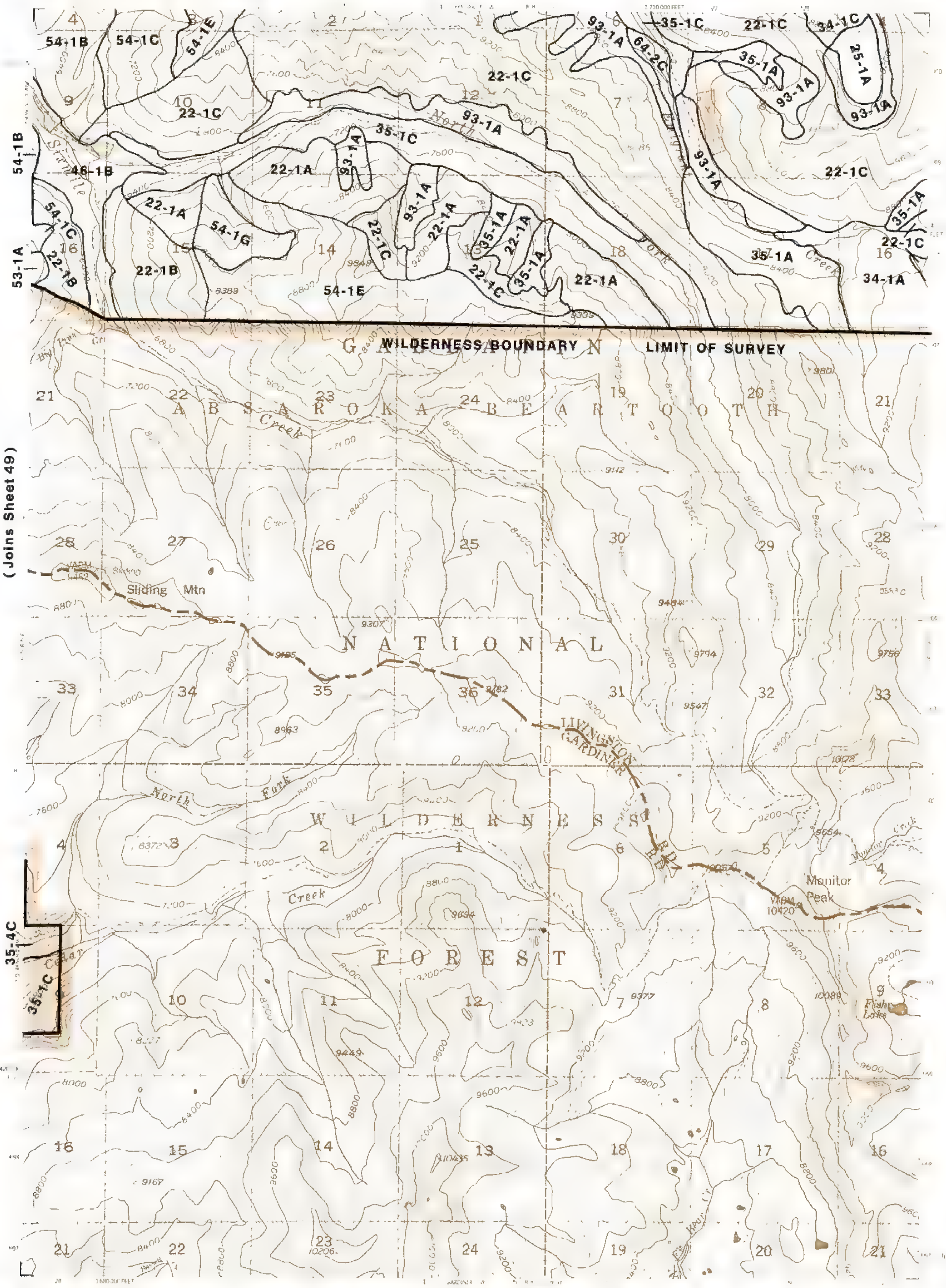
MINER N.E., MONTANA
N4507.5—W11045/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 50
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

GARDINER N W QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 43)



Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods. Aerial photographs taken 1949. Field check 1955

Polyconic projection. 1927 North American datum. 10,000 foot grid based on Montana coordinate system, south zone

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed. Location Reliable
Surveyed. Location Unreliable
Unsurveyed. B.M. Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GARDINER N.W., MONTANA
N4507.5—W11037.5/7.5
1955

SHEET NUMBER 51
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

GARDINER N E QUADRANGLE
MONTANA

(Joins Sheet 44)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 50)

(Joins Sheet 52)

(Joins Sheet 60)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GARDINER N.E., MONTANA
N4507.5 W11030/7.5
1955

SHEET NUMBER 52
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT WALLACE N.W. QUADRANGLE
MONTANA

(Joins Sheet 45)

(Joins Sheet 51)

(Joins Sheet 53)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey
Topography by J.E. Lewis and F.H. Purdy
Surveyed in 1937, 1938, and 1940
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana (South) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary	Primary Highway	Interstate	
National Forest Boundary	Secondary Highway	U.S. Highway	
Alienated Land within the National Forest Boundary	Light Duty Road	State Highway	
TOWNSHIP AND SECTION LINE CLASSIFICATION	Primitive Road	County Highway	
Surveyed, Location Reliable	Trail	Forest Road	
Surveyed, Location Unreliable		Forest Trail	
Unsurveyed, BLM Protraction			

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT WALLACE N W
MONTANA
N4507.5 W11022.5/7.5
1940

SHEET NUMBER 53
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT WALLACE N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 46)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 52)

(Joins Sheet 54)

Base map prepared by the Geological Survey
Topography by J.L. Lewis and F.H. Purdy
Surveyed in 1937, 1938, and 1940

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana (South) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway	Interstate
Secondary Highway	U.S. Highway
Light Duty Road	State Highway
Primitive Road	County Highway
Trail	Forest Road
	Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MOUNT WALLACE N.E.
MONTANA
N4507.5–W11015/7.5
1940

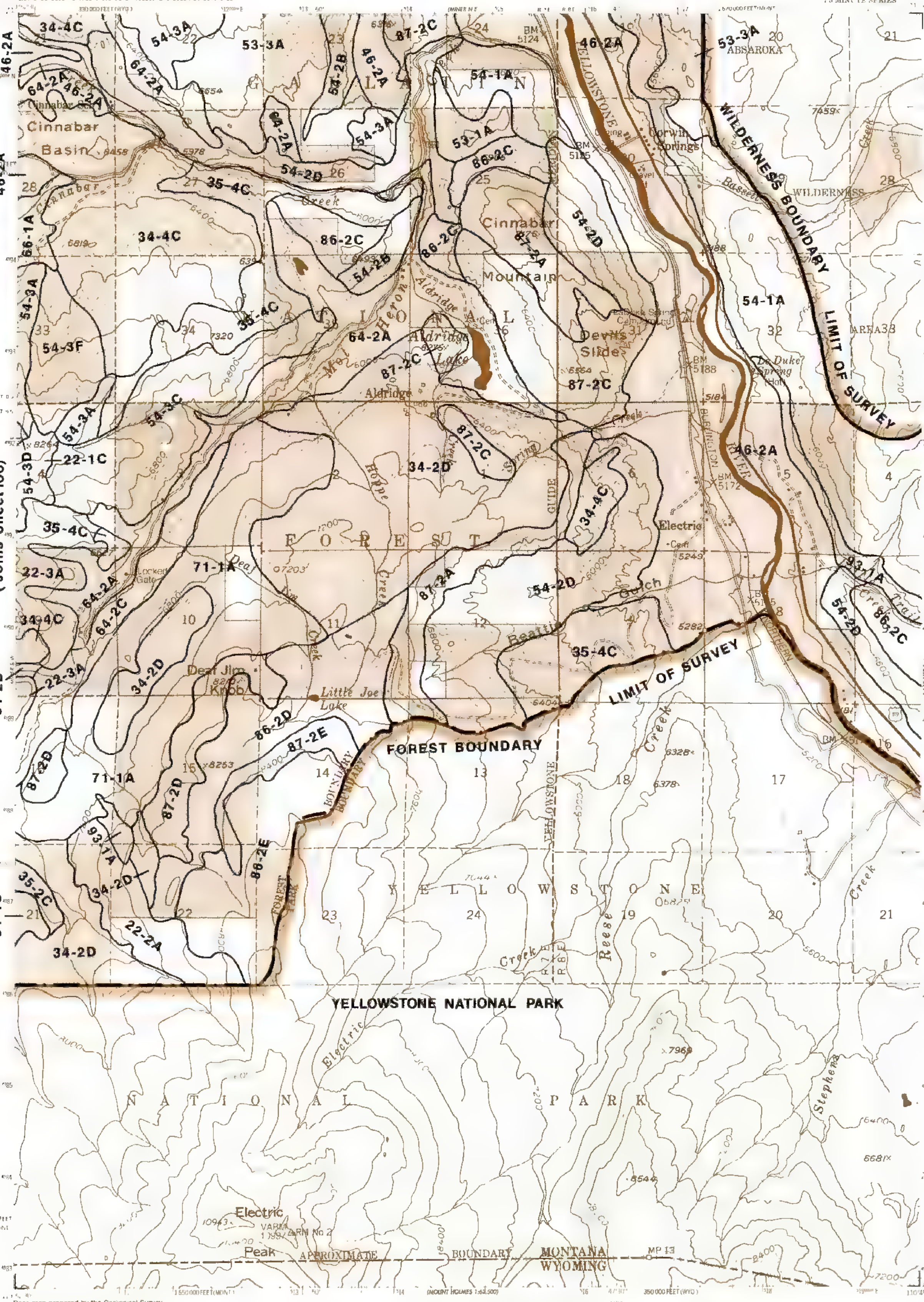
SHEET NUMBER 54
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

SHEET NUMBER 58
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MINER S.E. QUADRANGLE
MONTANA WYOMING
7.5 MINUTE SERIES



This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1954. Aerial photographs taken 1947—1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone and Wyoming coordinate system, west zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MINER S.E., MONT.-WYO.
N4500—W11045/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 59
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

GARDINER S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 50)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 58) **(Joins Sheet 60)**

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by multiplex methods. Aerial photographs taken 1949. Field check 1955
Polyconic projection. 1927 North American datum. 10,000 foot grid based on Montana coordinate system, south zone
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.
Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GARDINER S.W., MONTANA
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 60
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

GARDINER S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 51)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods. Aerial photographs taken 1949. Field check 1955

Polyconic projection. 1927 North American datum. 10,000 foot grid based on Montana coordinate system, south zone

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GARDINER S.E., MONTANA
N4500—W11037.5/7.5

1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 65
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

COOKE CITY S.W. QUADRANGLE
MONTANA-WYOMING
7.5 MINUTE SERIES

(Joins Sheet 66)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods Aerial photographs taken 1949 and 1951
Field check 1956

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordiante system, south zone and Wyoming coordinate system, west central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

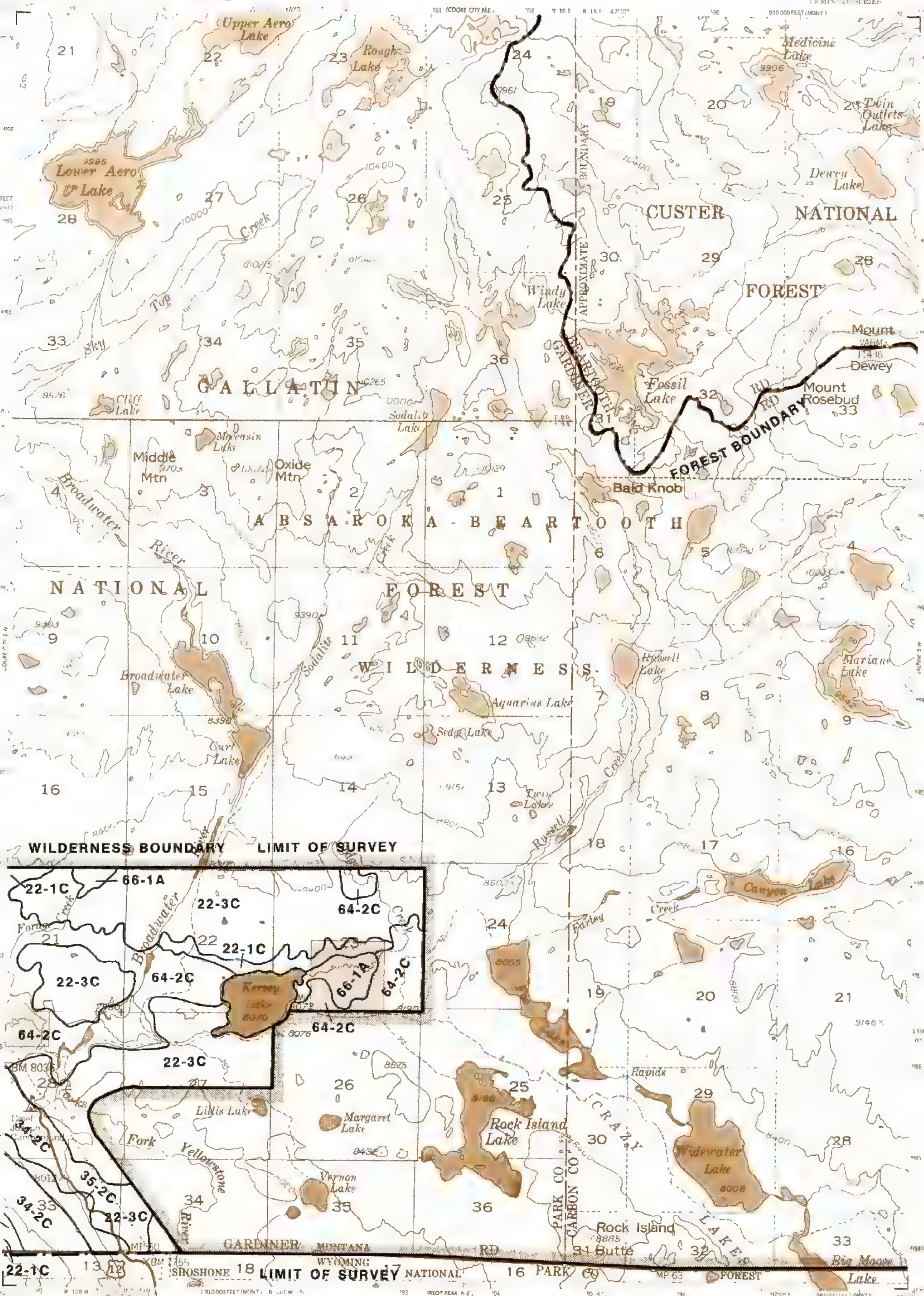
COOKE CITY S.W., MONT.-WYO.
N4500—W10952.5/7.5
1956

SHEET NUMBER 66
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

COOKE CITY S E QUADRANGLE
MONTANA WYOMING
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods Aerial photographs taken 1949 and 1951 Field check 1956.

Polyconic projection 1927 North American datum
10,000 foot grid based on Montana coordiante system south zone and Wyoming coordinate system, west central zone
1000 meter Universal Transverse Mercator grid ticks, zone 12 shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

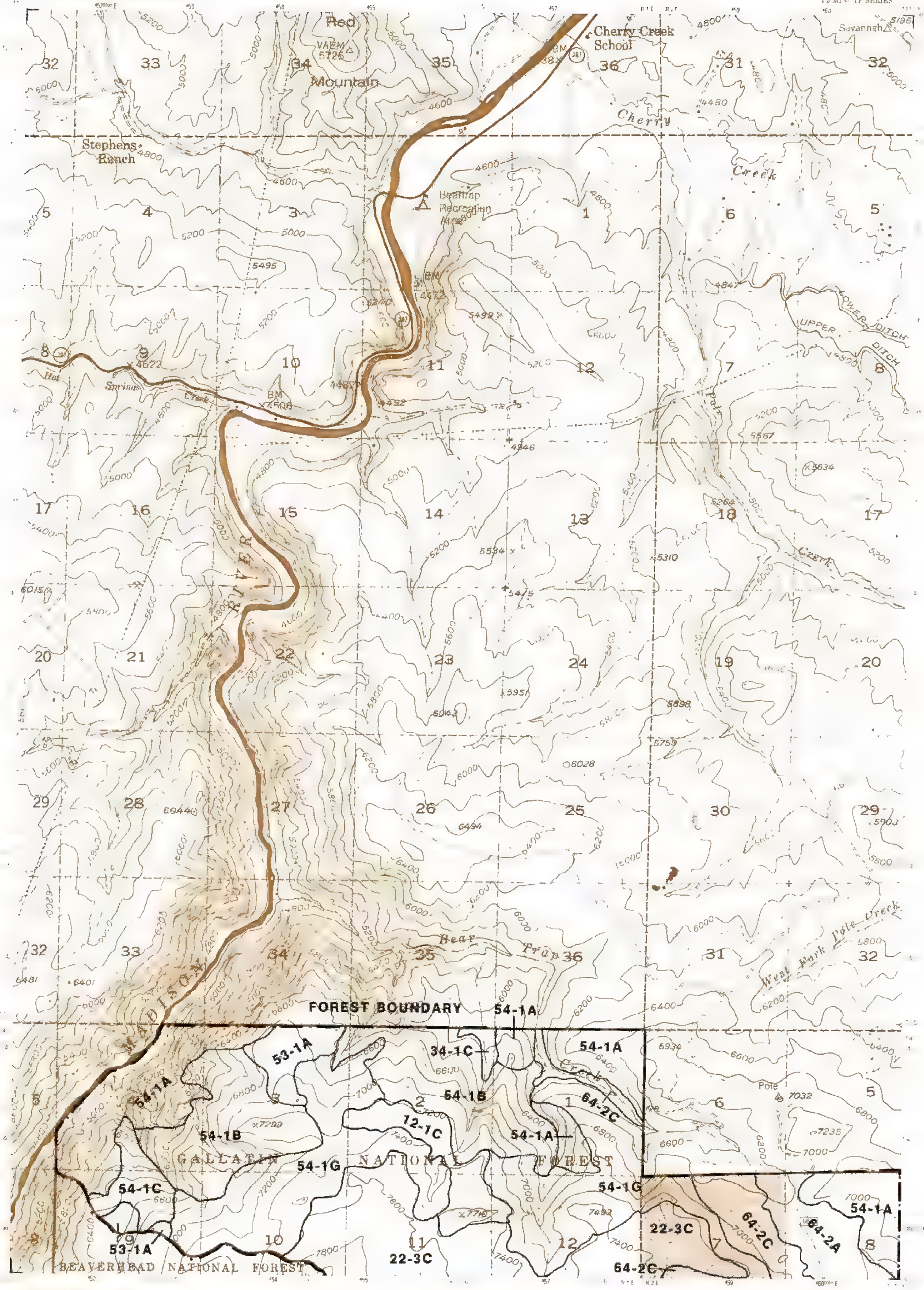
COOKE CITY S.E., MONT.-WYO.
N4500—W10945/7.5
1956

SHEET NUMBER 69
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

NORRIS SE QUADRANGLE
MONTANA - MADISON CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 76)

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate
Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

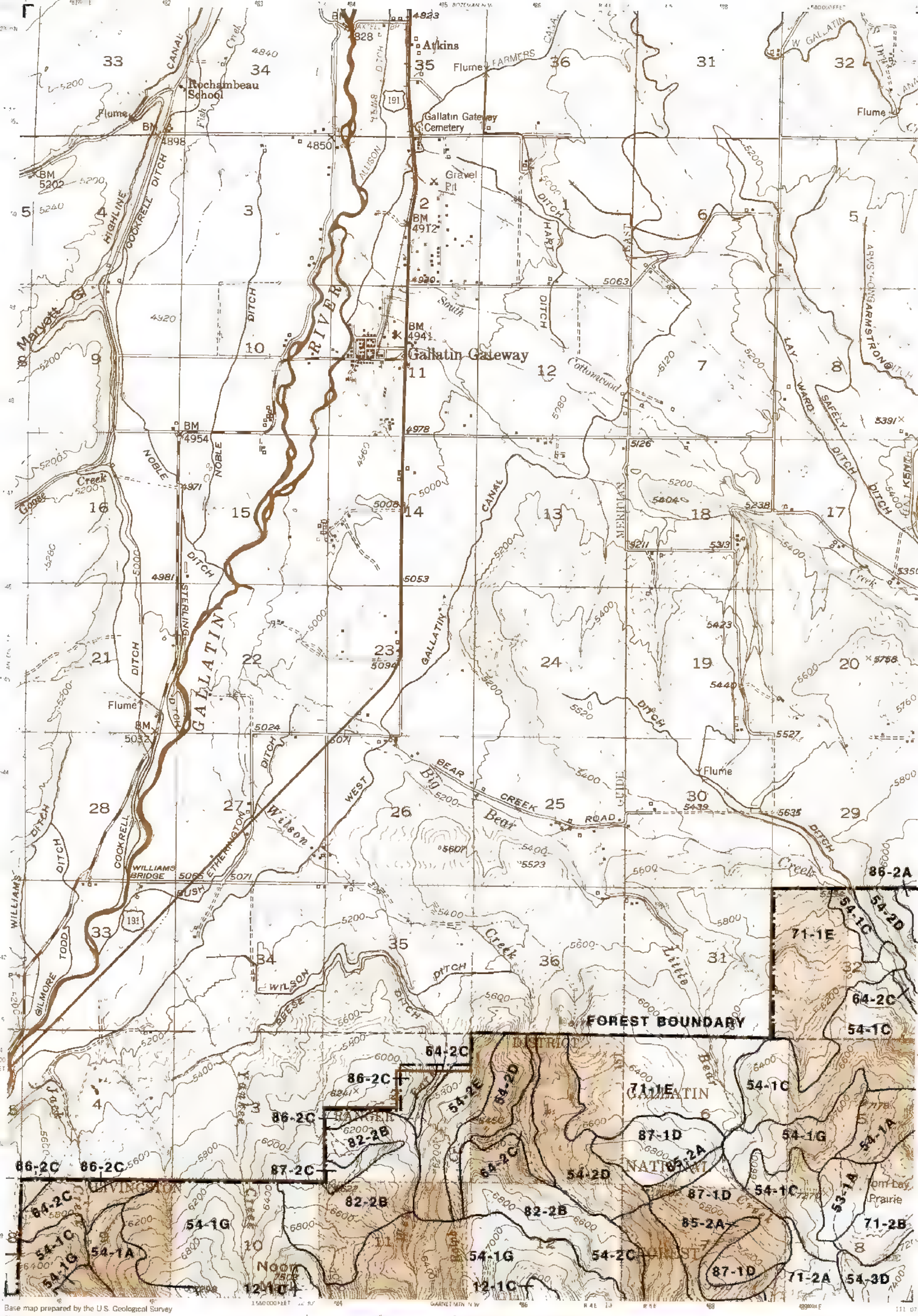
NORRIS SE, MONT.
1949

SHEET NUMBER 72
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BOZEMAN S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 79)

Base map prepared by the U.S. Geological Survey

Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947
Field check 1953

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BOZEMAN S.W., MONTANA
N4530- W11107.5/7.5

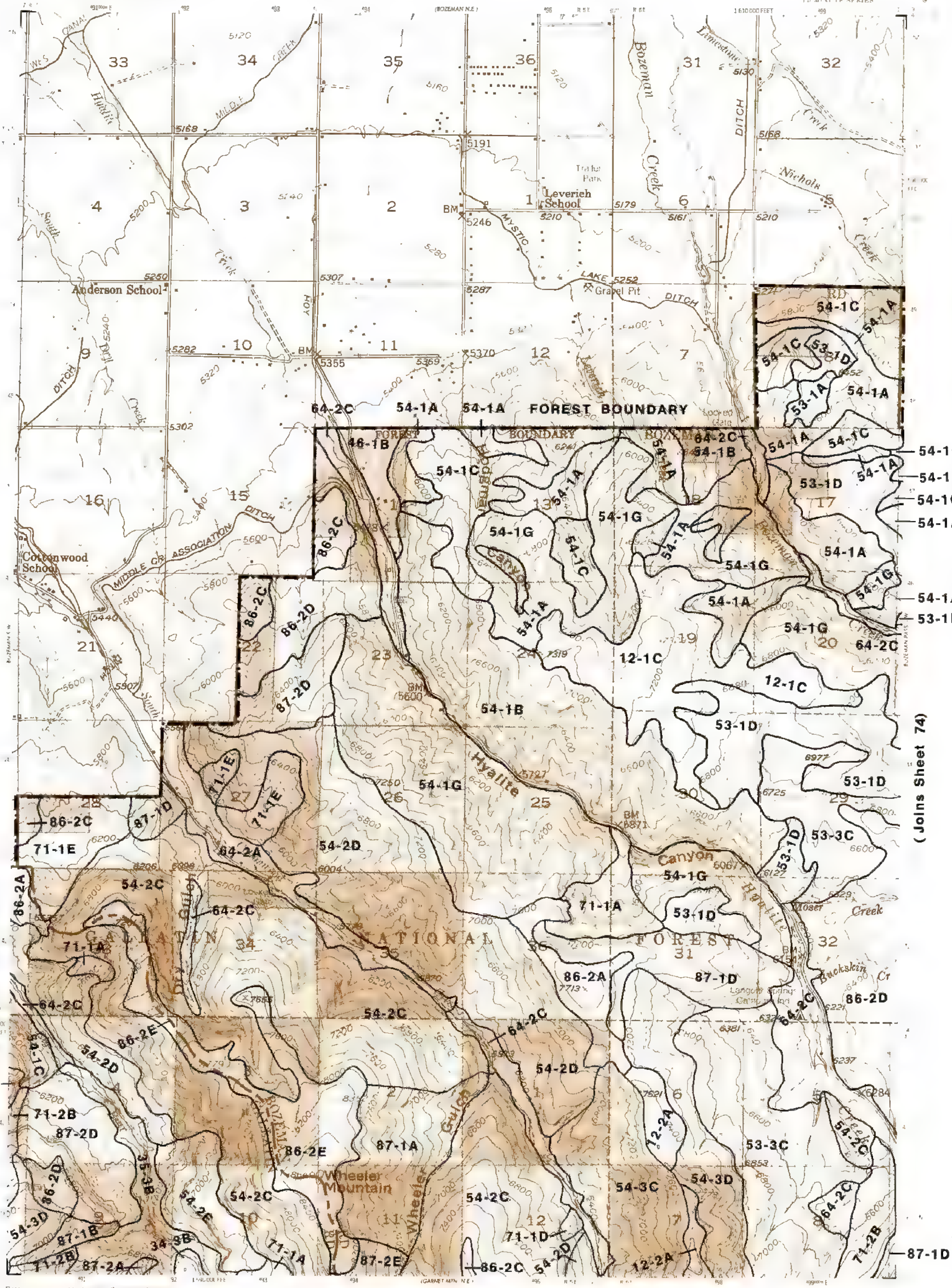
1953

SHEET NUMBER 73
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BOZEMAN S E QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



Base map prepared by the U.S. Geological Survey
Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS, USC&GS, and USFS

Topography from aerial photographs by stereoplanigraph methods. Aerial photographs taken 1947. Field check 1949

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, central and south zones

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

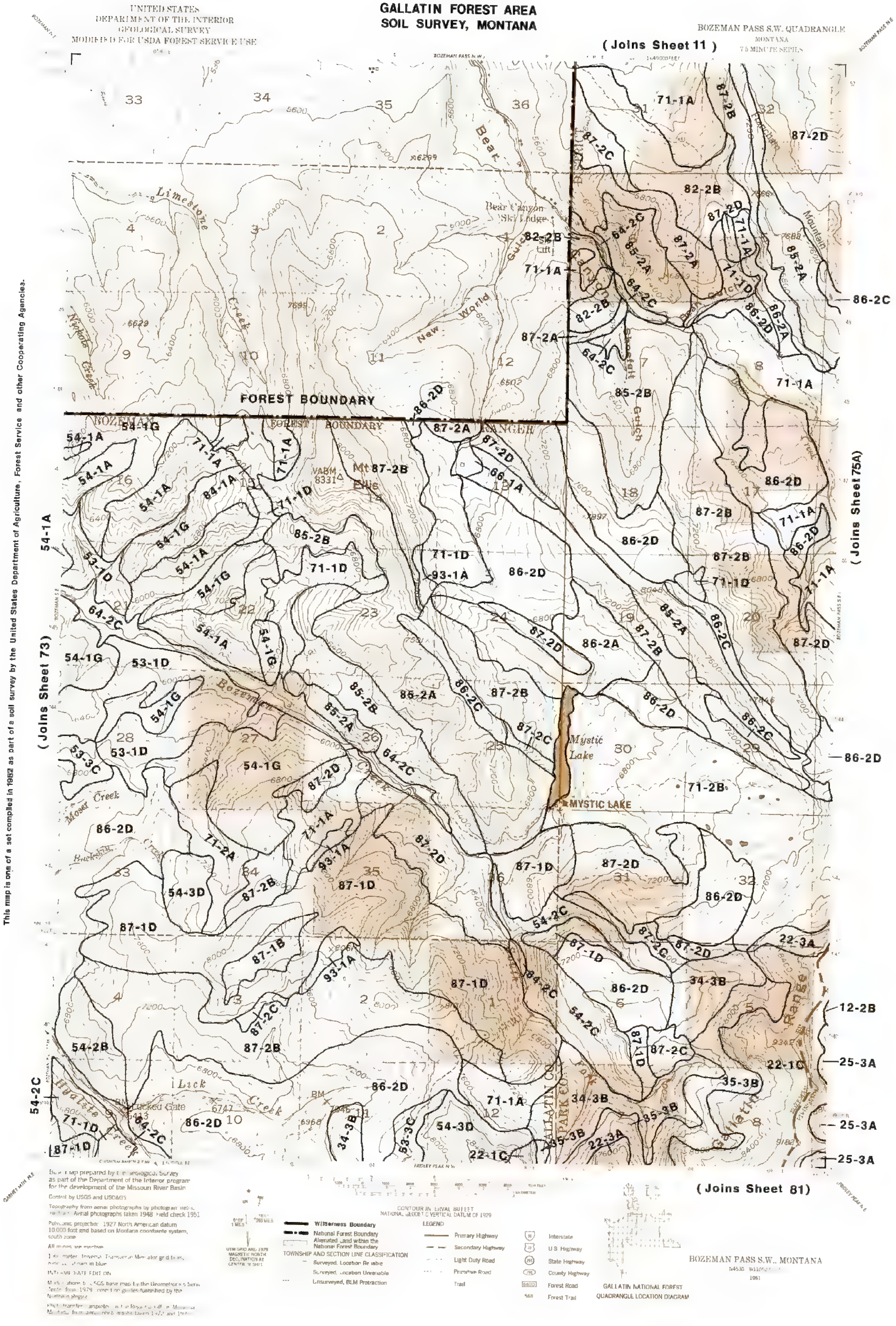
Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BOZEMAN S.E., MONTANA
N4530 W11100/7.5
1953

SHEET NUMBER 74
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA



SHEET NUMBER 75A
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

BOZEMAN PASS S.E. QUADRANGLE
IDAHO-MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BOZEMAN PASS S.E., MONT.
N4530-W11045/7.5
1951

SHEET NUMBER 75B
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CHIMNEY ROCK QUADRANGLE
MONTANA PARK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited and published by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1948. Field check 1951

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

Dashed land lines indicate approximate locations

APPROXIMATE MEAN DECLINATION, 1951

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium duty — Unimproved dirt
U. S. Route — State Route

QUADRANGLE LOCATION

CHIMNEY ROCK, MONT
N4530—W11037.5/7.5

1951

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, FEDERAL CENTER, DENVER, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 76
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

ENNIS NE QUADRANGLE
MONTANA - MADISON CO.

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate
Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

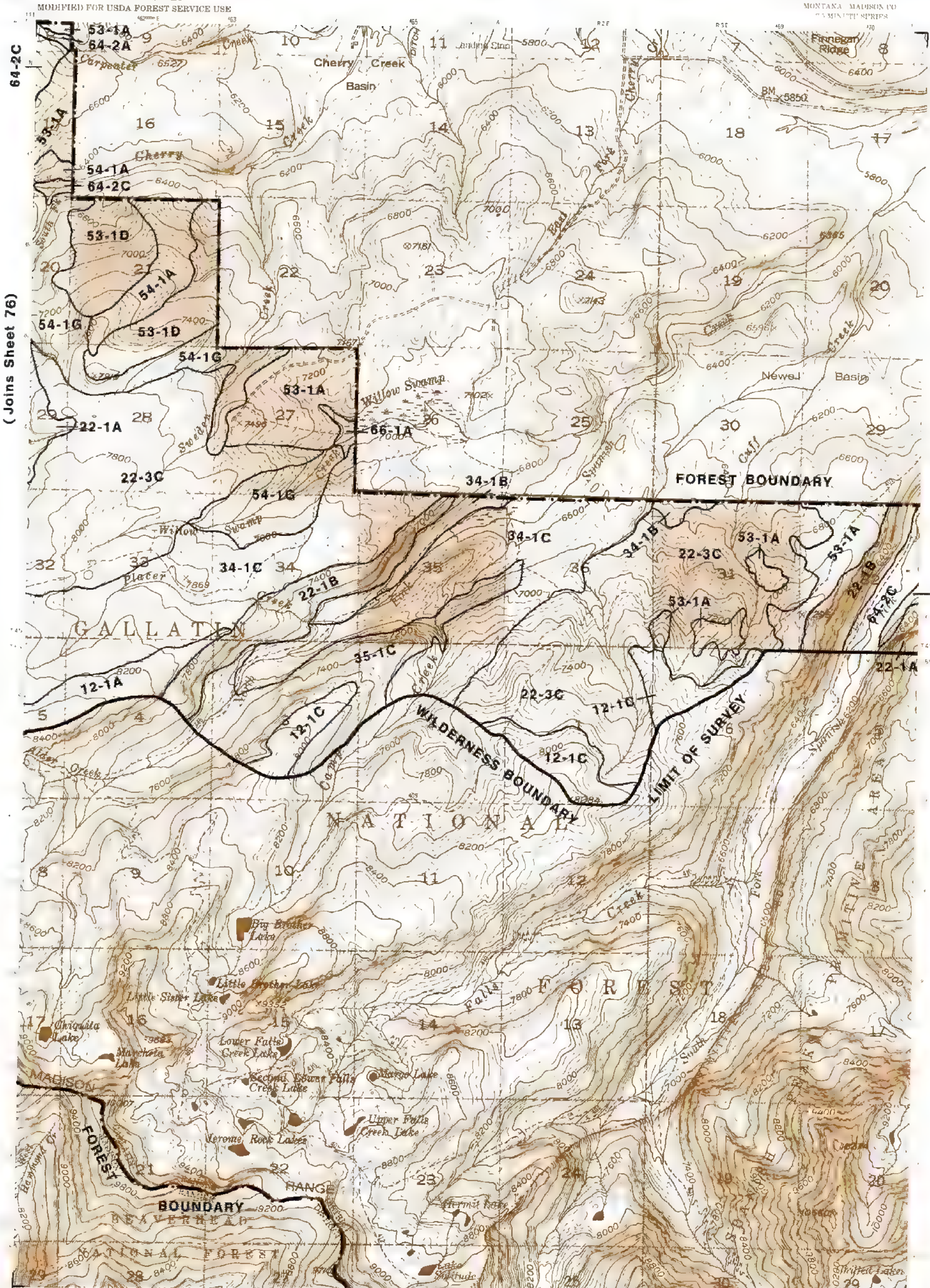
ENNIS NE, MONT.
N4522.5—W11130/7.5
1949

SHEET NUMBER 77
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SPANISH PEAKS NW QUADRANGLE
MONTANA MADISON CO.

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 85)

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate

Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

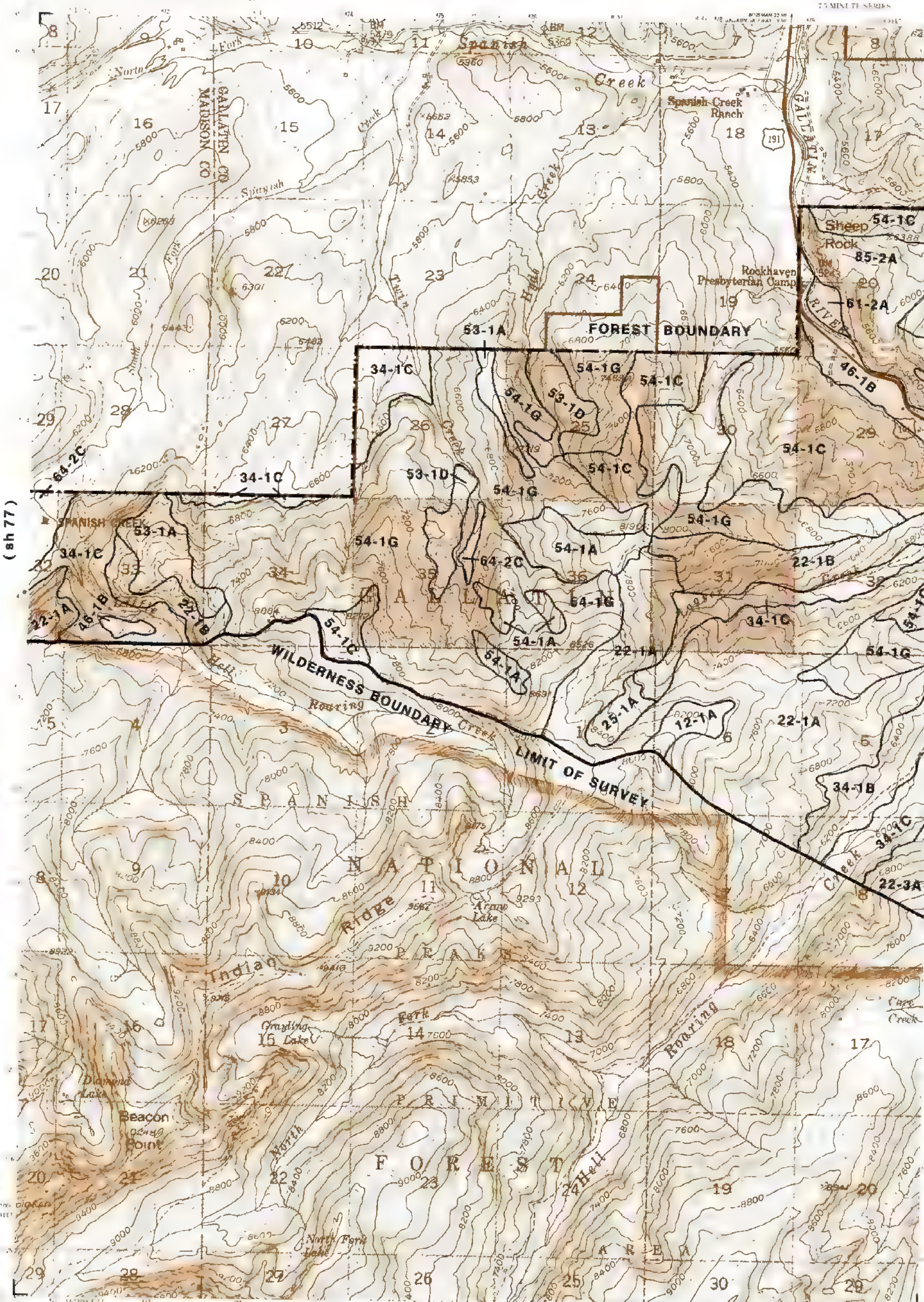
SPANISH PEAKS NW, MONT.
N4522.5—W11122.5/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 78
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

SPANISH PEAKS N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 86)

Base map prepared by the Geological Survey
Stereo compilation by Fairchild Aerial Surveys, Inc for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

SPANISH PEAKS N.E., MONTANA
N4515 W11115/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 79
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

GARNET MOUNTAIN N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

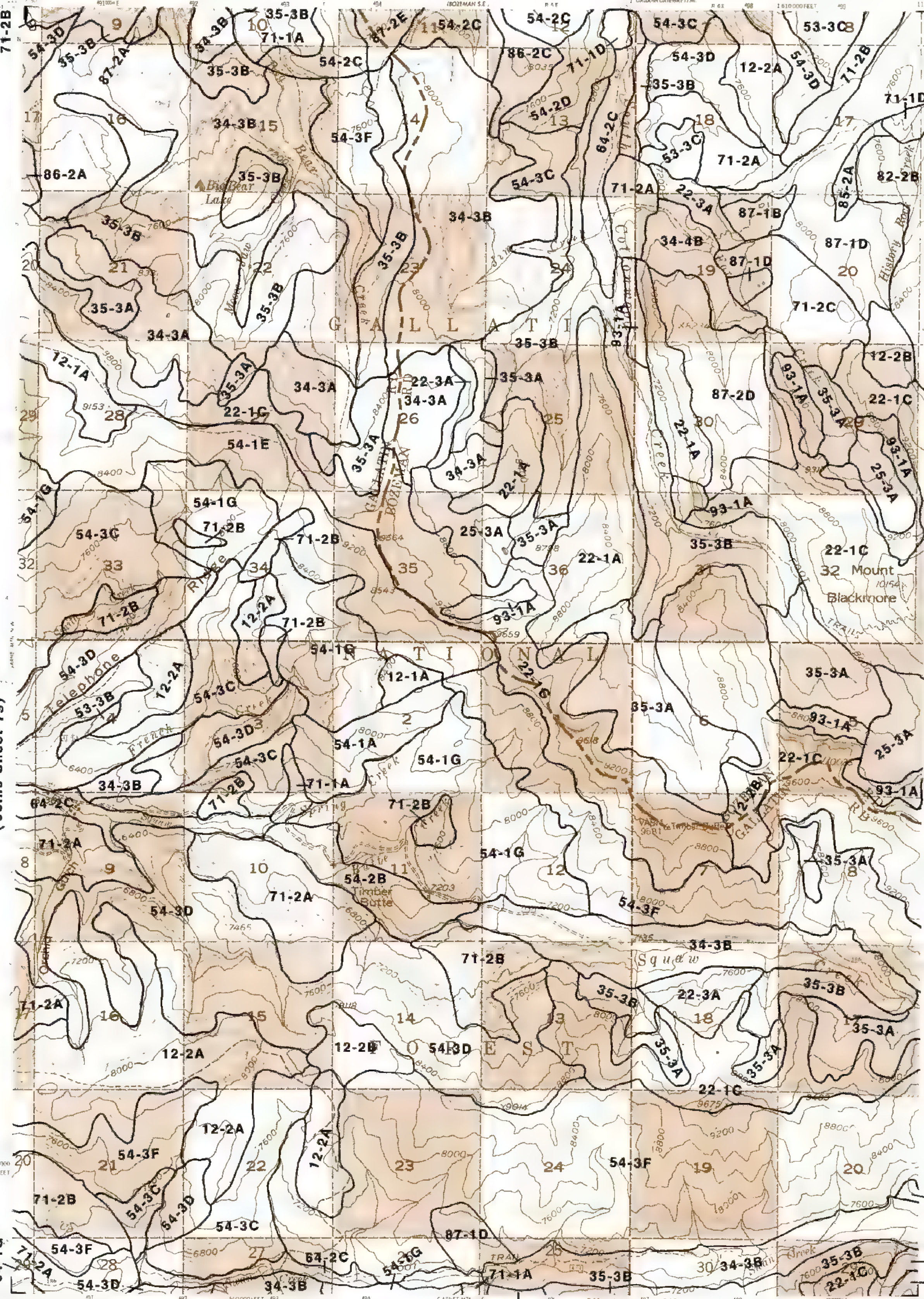
GARNET MOUNTAIN, N.W.
MONTANA
N4522.5—W11115/7.5
1955

SHEET NUMBER 80
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

GARNET MOUNTAIN N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 73)



(Joins Sheet 79)

(Joins Sheet 81)

22-3A

(Joins Sheet 88)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereophotographic methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Soil transfer completed by the Regional Office, Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary	
National Forest Boundary	
Alienated Land within the National Forest Boundary	
TOWNSHIP AND SECTION LINE CLASSIFICATION	
Surveyed, Location Reliable	
Surveyed, Location Unreliable	
Unsurveyed, BLM Protraction	
Primary Highway	Interstate
Secondary Highway	U.S. Highway
Light Duty Road	State Highway
Primitive Road	County Highway
Trail	Forest Road
	Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GARNET MOUNTAIN N.E., MONTANA
N4522.5—W11100/7.5
1955

SHEET NUMBER 81
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

FRIDLEY PEAK N.W. QUADRANGLE

(Joins Sheet 74)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 80)

(Joins Sheet 82)

(Joins Sheet 89)

FRIDLEY PEAK N.W., MONTANA

SHEET NUMBER 82
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

FRIDLEY PEAK N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 75A)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 81)

(Joins Sheet 42)

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Planimetry compiled by the Regional Office, Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary	Primary Highway
National Forest Boundary	Secondary Highway
Alienated Land within the National Forest Boundary	Light Duty Road
TOWNSHIP AND SECTION LINE CLASSIFICATION	Primitive Road
Surveyed, Location Reliable	Trail
Surveyed, Location Unreliable	
Unsurveyed, BLM Protraction	

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

FRIDLEY PEAK N.E. MONTANA
N4522.5—W11045/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 85
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

SPANISH PEAKS SW QUADRANGLE
MONTANA MADISON CO.

(Joins Sheet 77)

(Joins Sheet 86)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 91)

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed Location Reliable
Surveyed Location Approximate
Unsurveyed Protracted

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate

Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

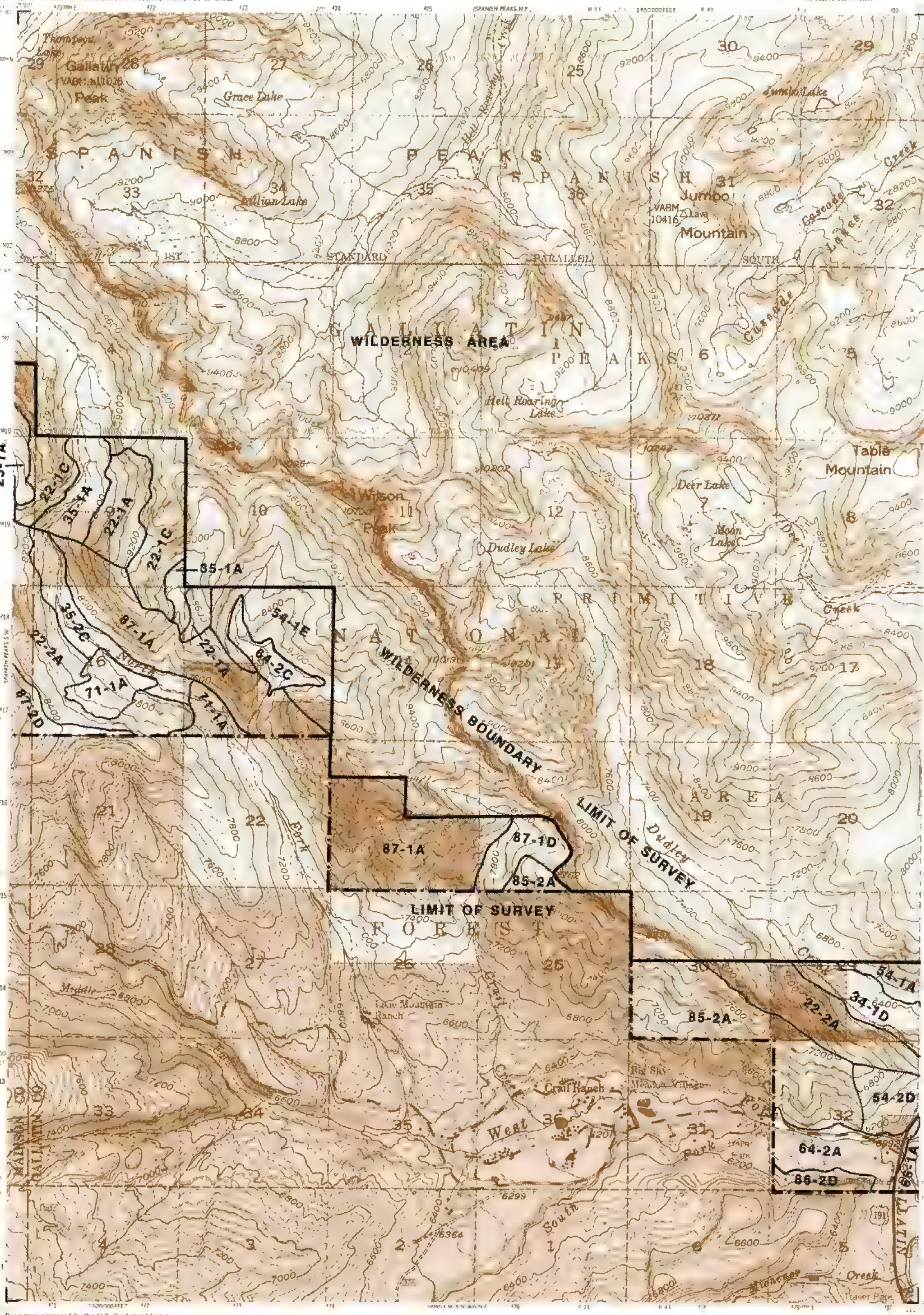
SPANISH PEAKS SW, MONT.
N4515 W11122.5/7.5
1950

SHEET NUMBER 86
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SPANISH PEAKS S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 78)



(Joins Sheet 85)

(Joins Sheet 87)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 92)

Base map prepared by the U.S. Geological Survey

Stereo compilation by Fairchild Aerial Surveys, Inc.
for the Bureau of Reclamation
Field examination and publication by the Geological Survey
as part of the Department of the Interior program
for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

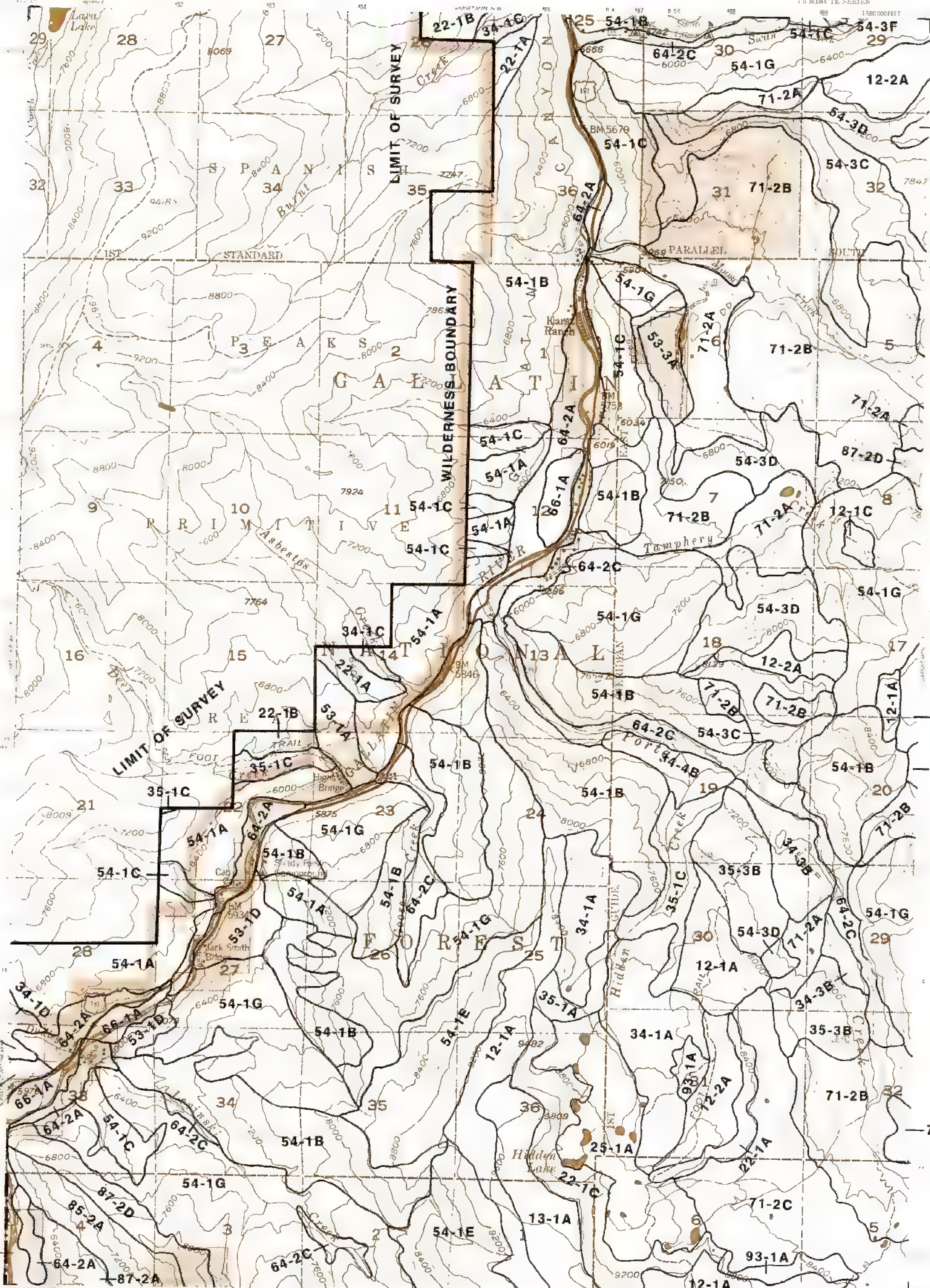
SPANISH PEAKS S.E., MONTANA
N4515 W11115/7.5
1950

SHEET NUMBER 87
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

GARNET MOUNTAIN S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 79)



Map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
568 Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

(Joins Sheet 93)

GARNET MOUNTAIN S.W.
MONTANA

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

SHEET NUMBER 88
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

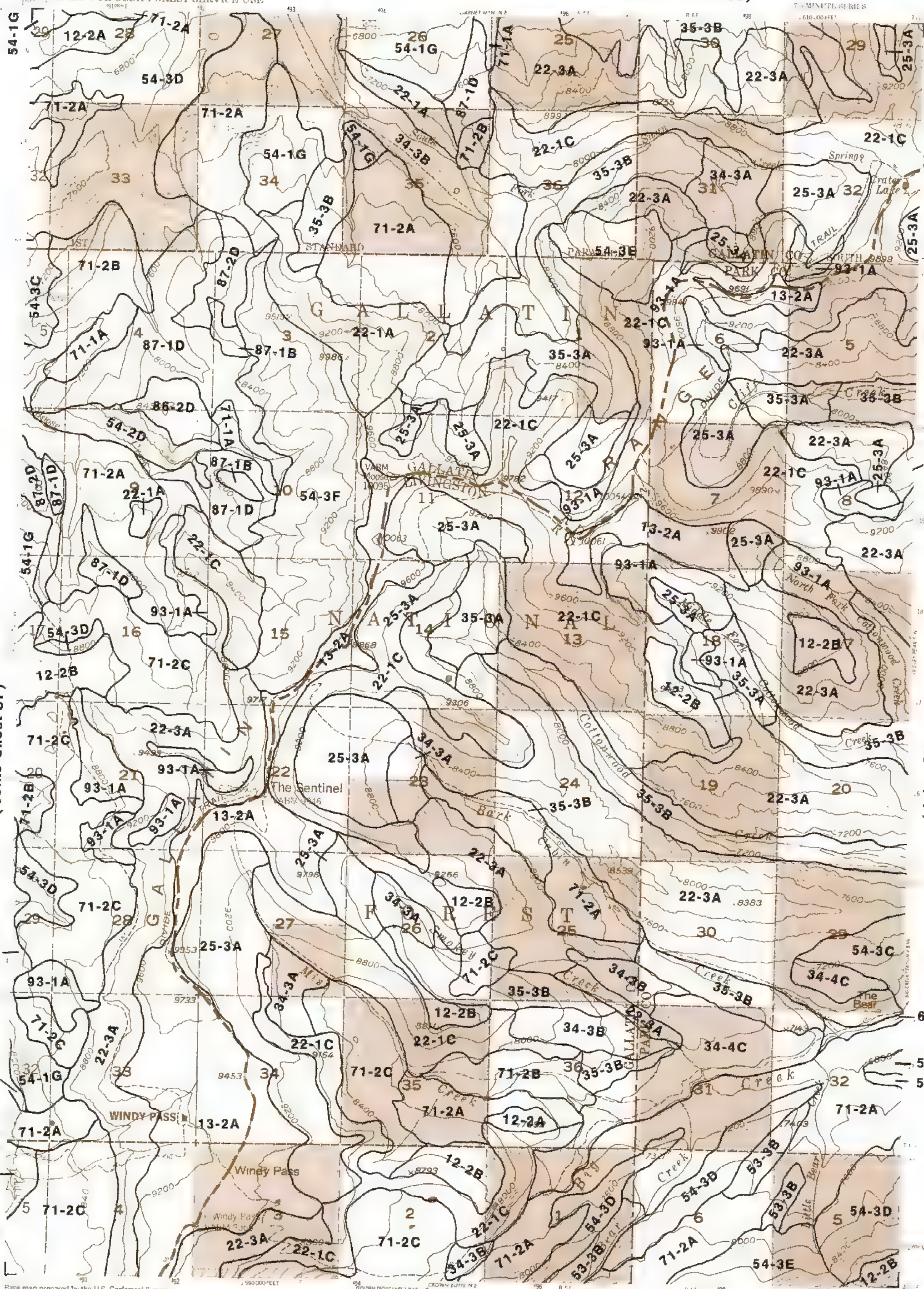
GARNET MOUNTAIN S.E. QUADRANGLE

(Joins Sheet 80)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 87)

(Joins Sheet 89)



(Joins Sheet 94)

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone

1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

GARNET MOUNTAIN S.E.
MONTANA
N4515—W11100/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 89
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

FRIDLEY PEAK S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U.S. Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by stereophotogrammetric methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system south zone
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

FRIDLEY PEAK S.W. MONTANA
N4515—W11045/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 90
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

CAMERON NE QUADRANGLE
MONTANA MADISON CO.
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1973

UTM GRID AND 1950 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate
Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

CAMERON NE, MONT.
N4507.5—W11130/7.5
1950

SHEET NUMBER 91
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 85)

SPHINX MOUNTAIN NW QUADRANGLE
MONTANA—MADISON CO.

(Joins Sheet 90)

(Joins Sheet 92)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate

Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

SPHINX MOUNTAIN NW, MONT
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 92
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

SPHINX MOUNTAIN NE QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 86)

(Joins Sheet 91)

(Joins Sheet 93)

(Joins Sheet 97)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Stereo compilation by Fairchild Aerial Surveys, Inc for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 12

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1973

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate

Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

SPHINX MOUNTAIN NE, MONT.
N4507.5—W11115/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

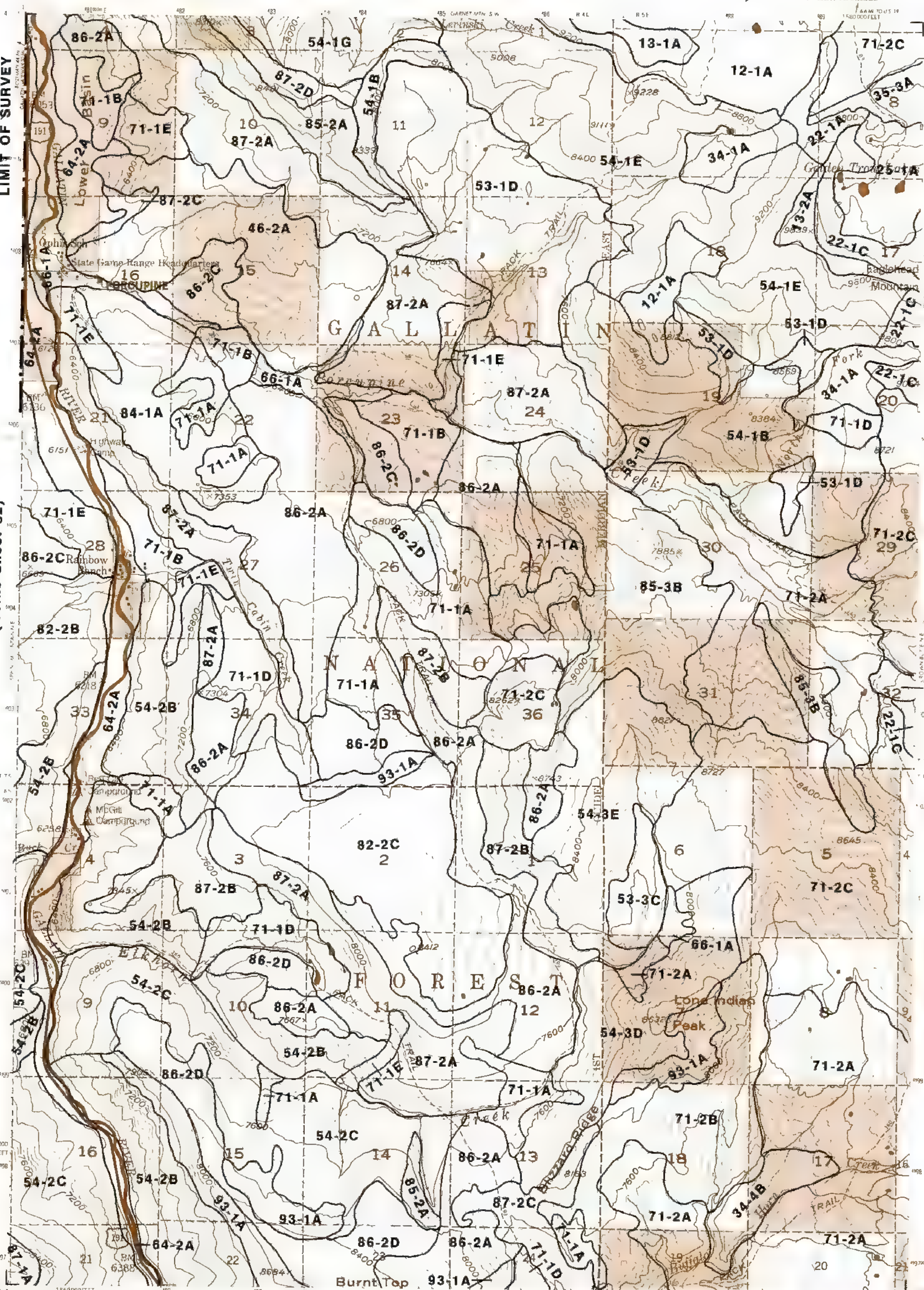
CROWN BUTTE N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 87)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 92)

(Joins Sheet 94)



Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10 000-foot grid based on Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway	Interstate
Secondary Highway	U S Highway
Light Duty Road	State Highway
Primitive Road	County Highway
Trail	Forest Road
	Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

(Joins Sheet 98)

CROWN BUTTE N.W., MONTANA
N4507.5—W11107.5/7.5
1956

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 94
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

CROWN BUTTE N.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1956

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

CROWN BUTTE N.E., MONTANA
N4507.5—W11100/7.5
1956

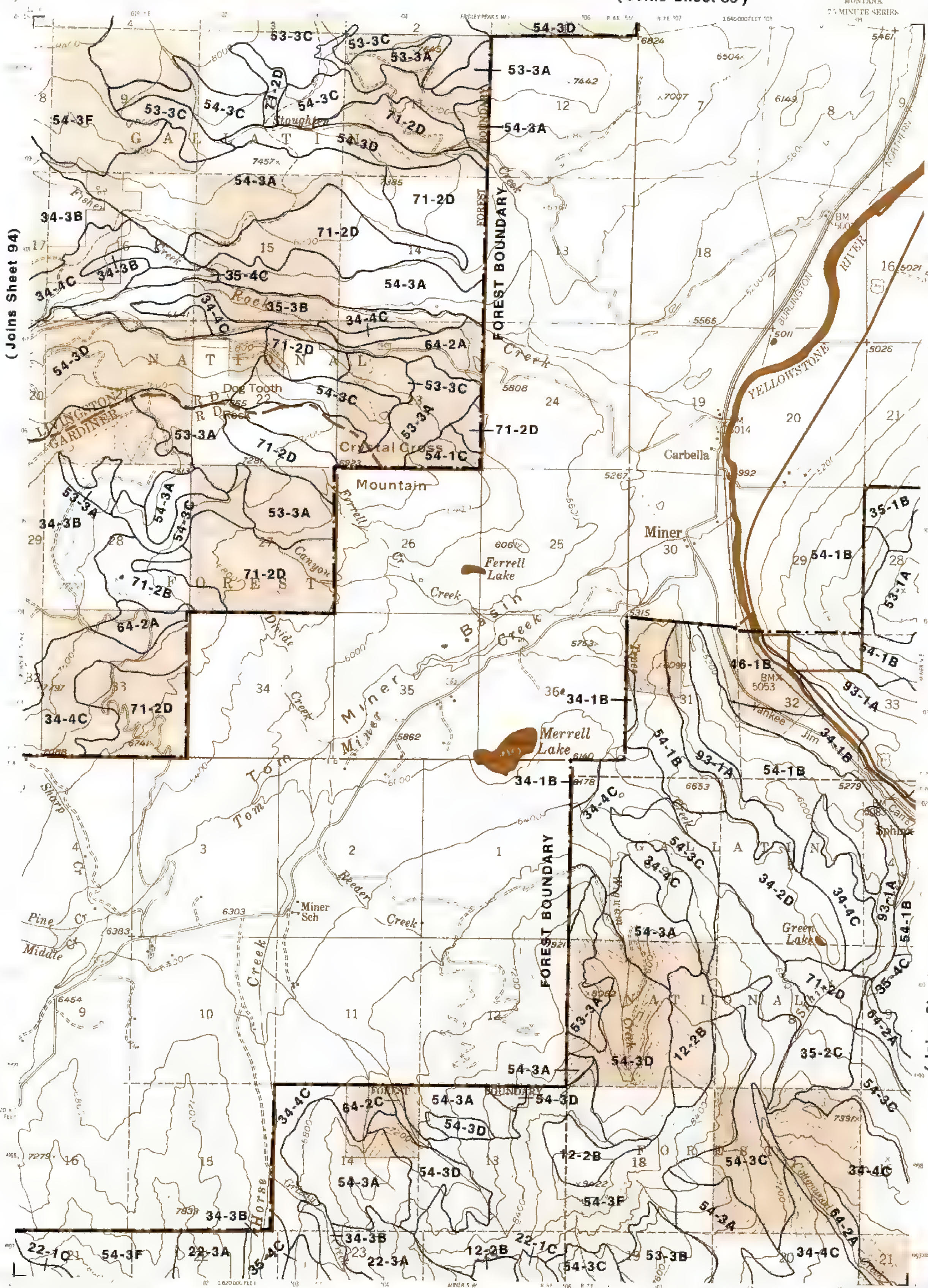
SHEET NUMBER 95
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MINER N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 89)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 100)

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1954. Aerial photographs taken 1947–1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone and Wyoming coordinate system, west zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

MINER N.W., MONTANA
N4507.5—W11052.5/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 96
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

SPHINX MOUNTAIN S W QUADRANGLE
MONTANA—MADISON CO.

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 97)

Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950
Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone
1000 meter Universal Transverse Mercator grid ticks, zone 12
INTERMEDIATE EDITION
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary as of 1979
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protracted

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Gate
Interstate Highway
U.S. Highway
State Highway
County Road
Forest Road
Forest Trail

BEAVERHEAD NATIONAL FOREST

SPHINX MOUNTAIN SW, MONT.
N4500—W11122.5/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

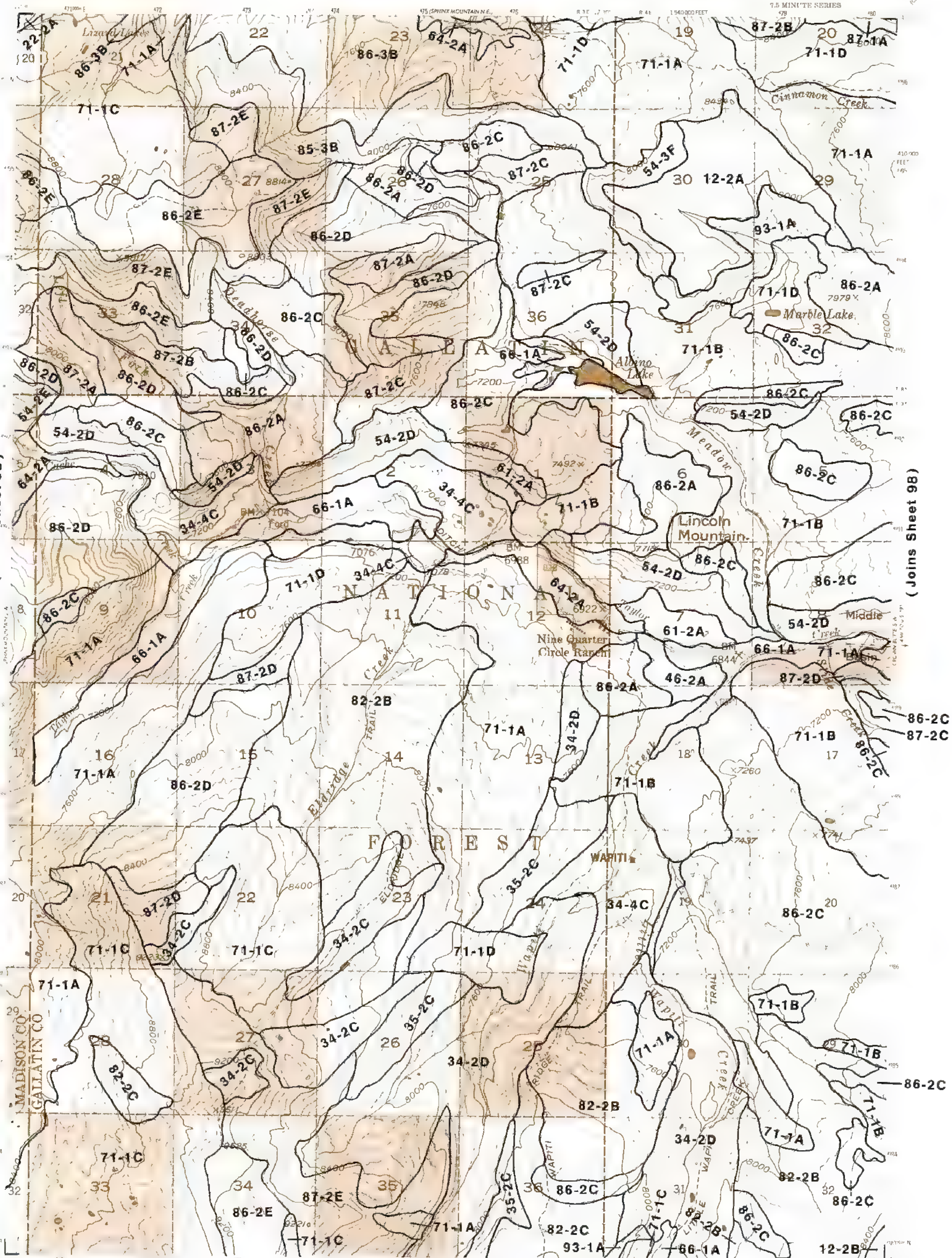
SHEET NUMBER 97
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

(Joins Sheet 92)

SPHINX MOUNTAIN S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 96)



(Joins Sheet 98)

(Joins Sheet 102)

Stereo compilation by Fairchild Aerial Surveys, Inc for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947
Field check 1950
Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
INTERMEDIATE EDITION

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

SPHINX MTN S.E., MONTANA
N4500 W11115/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 98
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

CROWN BUTTE S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

- Wilderness Boundary
- National Forest Boundary
- Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Unreliable
- Unsurveyed, BLM Protraction

- Primary Highway
- Secondary Highway
- Light Duty Road
- Primitive Road
- Trail

- Interstate
- U.S. Highway
- State Highway
- County Highway
- Forest Road
- Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

CROWN BUTTE S.W., MONTANA
N4500—W11107.5/7.5
1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SHEET NUMBER 99
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

CROWN BUTTE S.E. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948 for the Bureau of Reclamation and by multiplex methods 1954 by USGS
Aerial photographs taken 1947 and 1949. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

CROWN BUTTE S.E., MONTANA
N4500—W11100/7.5
1955

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

SHEET NUMBER 100
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 101
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

HEBGEN DAM N.W. QUADRANGLE
MONTANA IDAHO
7.5 MINUTE SERIES

(Joins Sheet 96)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 105)

Stereo compilation by Fairchild Aerial Surveys, Inc for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone and Idaho coordinate system, east zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

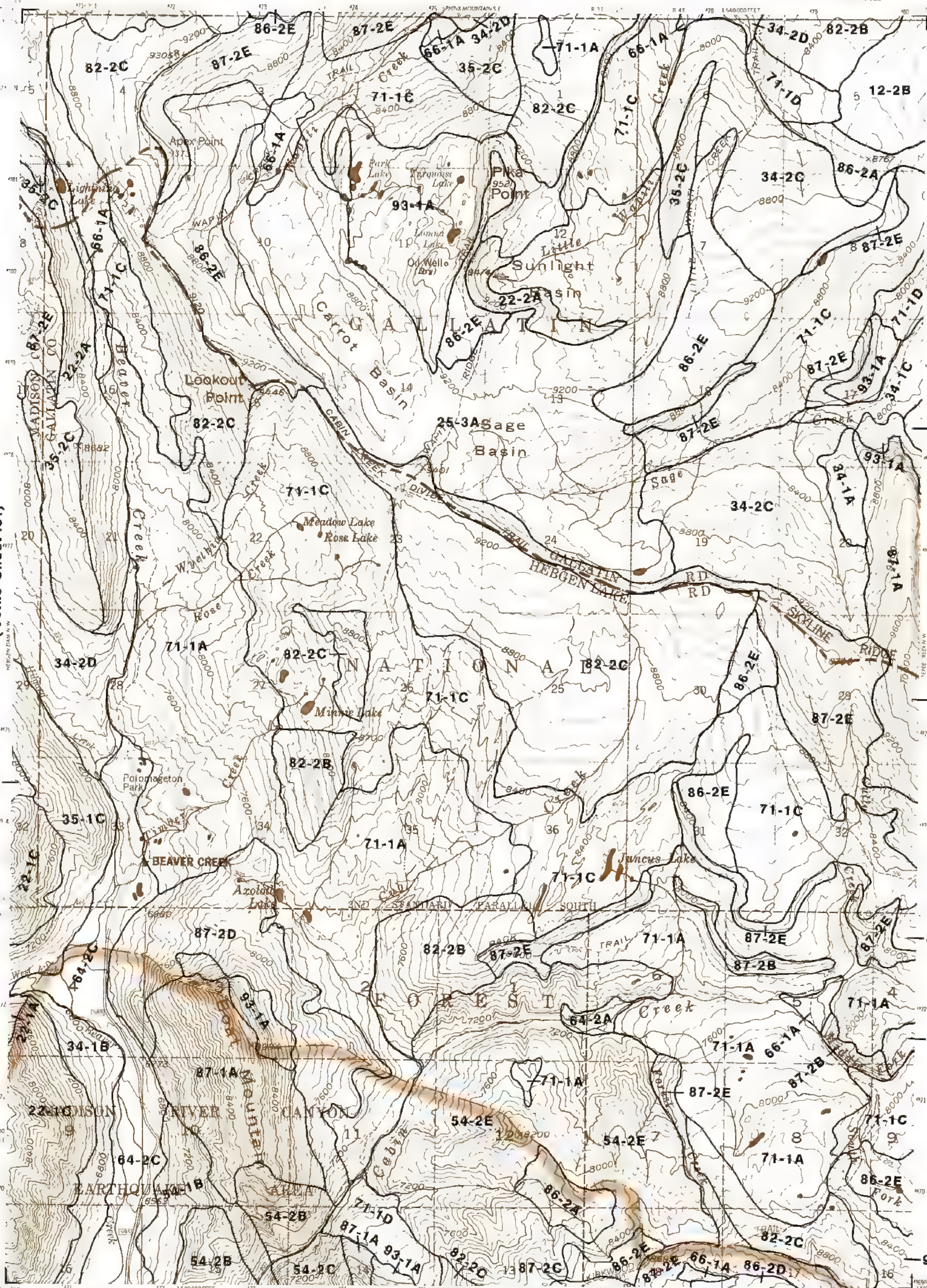
HEBGEN DAM N.W., MONTANA
N4452.5—W11122.5/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 102
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

HEBGEN DAM N.E. QUADRANGLE
MONTANA IDAHO
7.5 MINUTE SERIES

(Joins Sheet 97)



(Joins Sheet 101)

(Joins Sheet 103)

(Joins Sheet 106)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Stereo compilation by Fairchild Aerial Surveys Inc. for the Bureau of Reclamation
Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone and Idaho coordinate system, east zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

HEBGEN DAM N.E., MONTANA
N4452.5—W11115/7.5
1950

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 103
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

(Joins Sheet 98)

TEPEE CREEK N.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 102)

(Joins Sheet 104)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 107)

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1958 Aerial photographs taken 1947 and 1954. Field checked 1958

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone Wyoming coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17, 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 197[illegible]

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

TEPEE CREEK N.W., MONTANA
N4452.5—W11107.5/7.5
1958

SHEET NUMBER 104
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

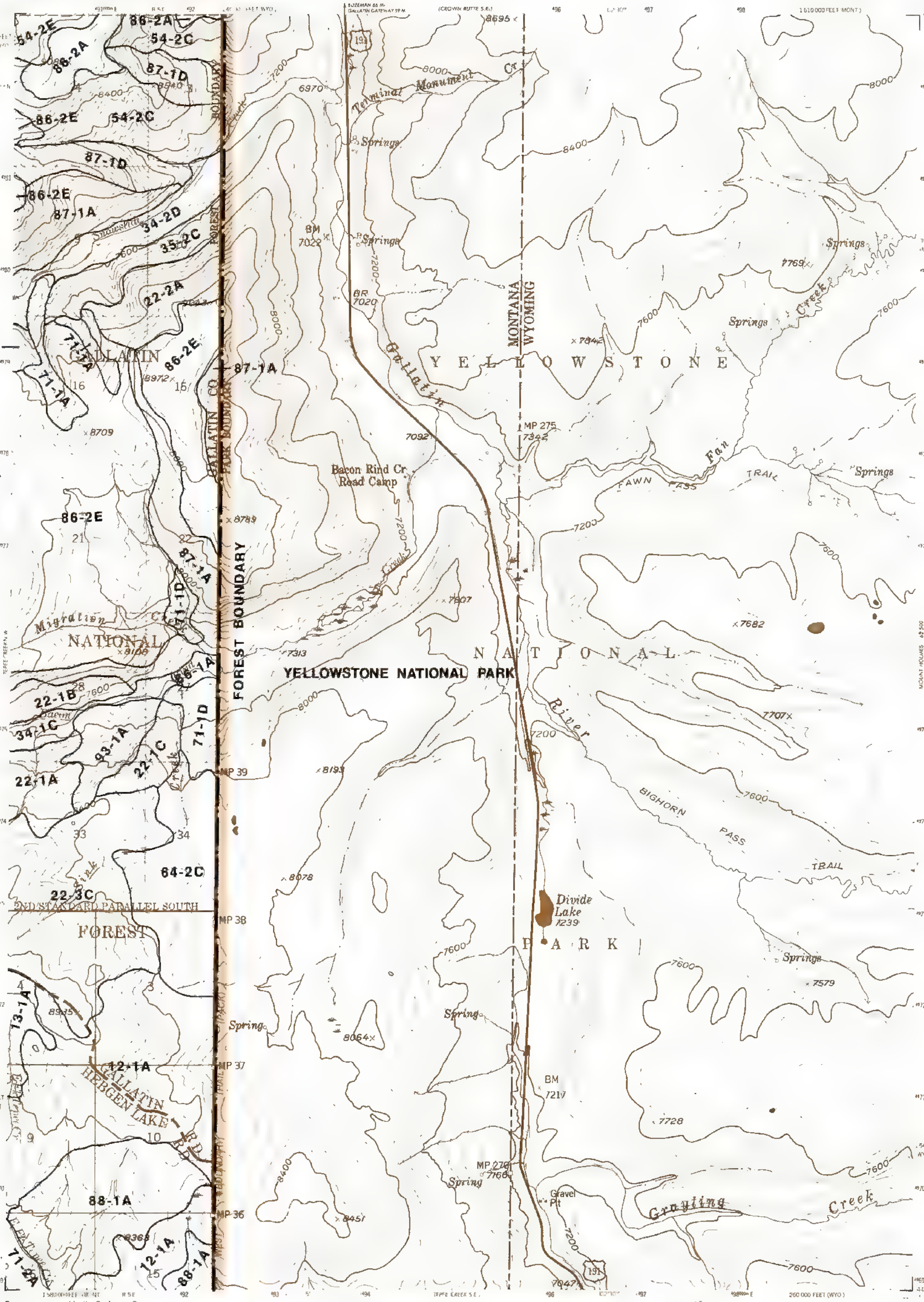
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

TEPEE CREEK N.E. QUADRANGLE
MONTANA WYOMING
7.5 MINUTE SERIES

(Joins Sheet 99)

(Joins Sheet 103)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 108)

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1958 Aerial photographs taken 1947 and 1954 Field checked 1958

Polyconic projection 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone Wyoming coordinate system west zone
1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

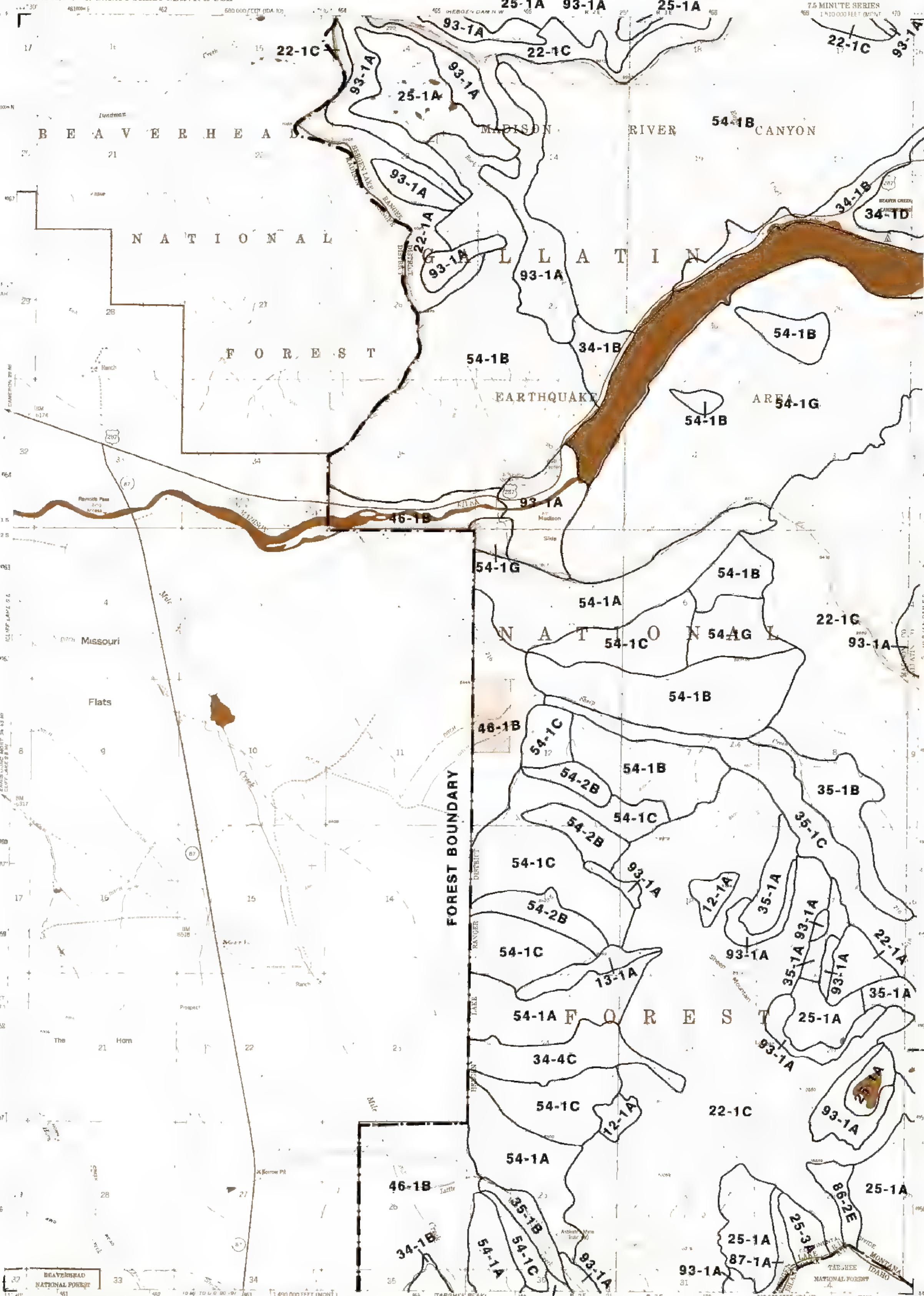
TEPEE CREEK N.E., MONT.-WYO.
N4452.5 W11100/7.5
1958

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 105
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

HEBGEN DAM S.W. QUADRANGLE
MONTANA IDAHO
7.5 MINUTE SERIES

(Joins Sheet 101)



(Joins Sheet 106)

(Joins Sheet 109)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Stereo compilation by Fairchild Aerial Surveys, Inc. for the Bureau of Reclamation

Field examination and publication by the Geological Survey as part of the Department of the Interior program for the development of the Missouri River Basin

Control by USGS and USC&GS

Topography from aerial photographs by stereoplanigraph methods 1948. Aerial photographs taken 1947. Field check 1950

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone and Idaho coordinate system, east zone

1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

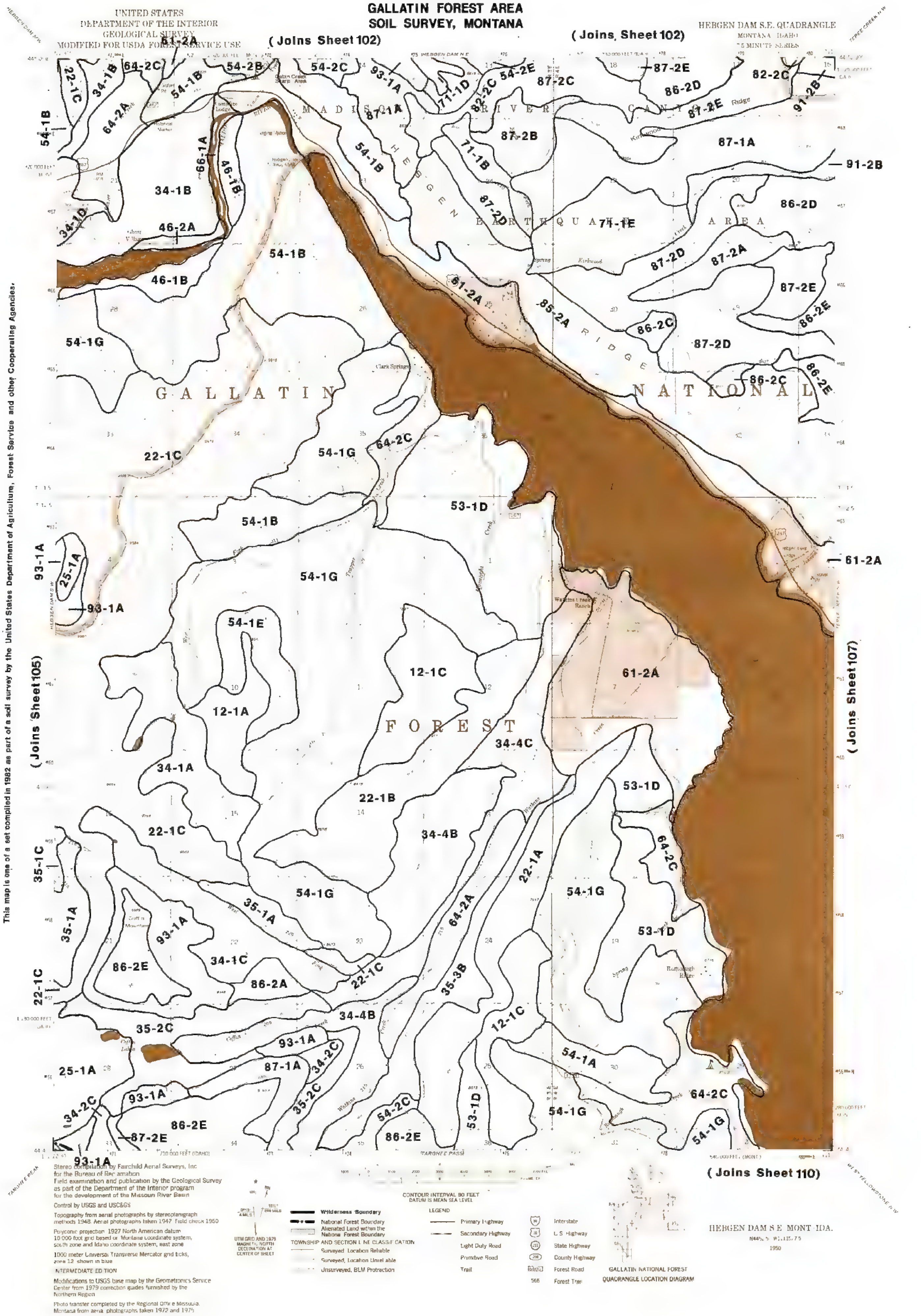
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

HEBGEN DAM S.W., MONT.-IDA.
N4445—W11122.5/7.5

SHEET NUMBER 106
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 107
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

TEPEE CREEK S.W. QUADRANGLE
MONTANA
7.5 MINUTE SERIES

(Joins Sheet 103)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

(Joins Sheet 106)

(Joins Sheet 108)

(Joins Sheet 111)

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1958. Aerial photographs taken 1947 and 1954. Field checked 1958

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone Wyoming coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17, 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway		Interstate	
Secondary Highway		U.S. Highway	
Light Duty Road		State Highway	
Primitive Road		County Highway	
Trail		Forest Road	
	568	Forest Trail	

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

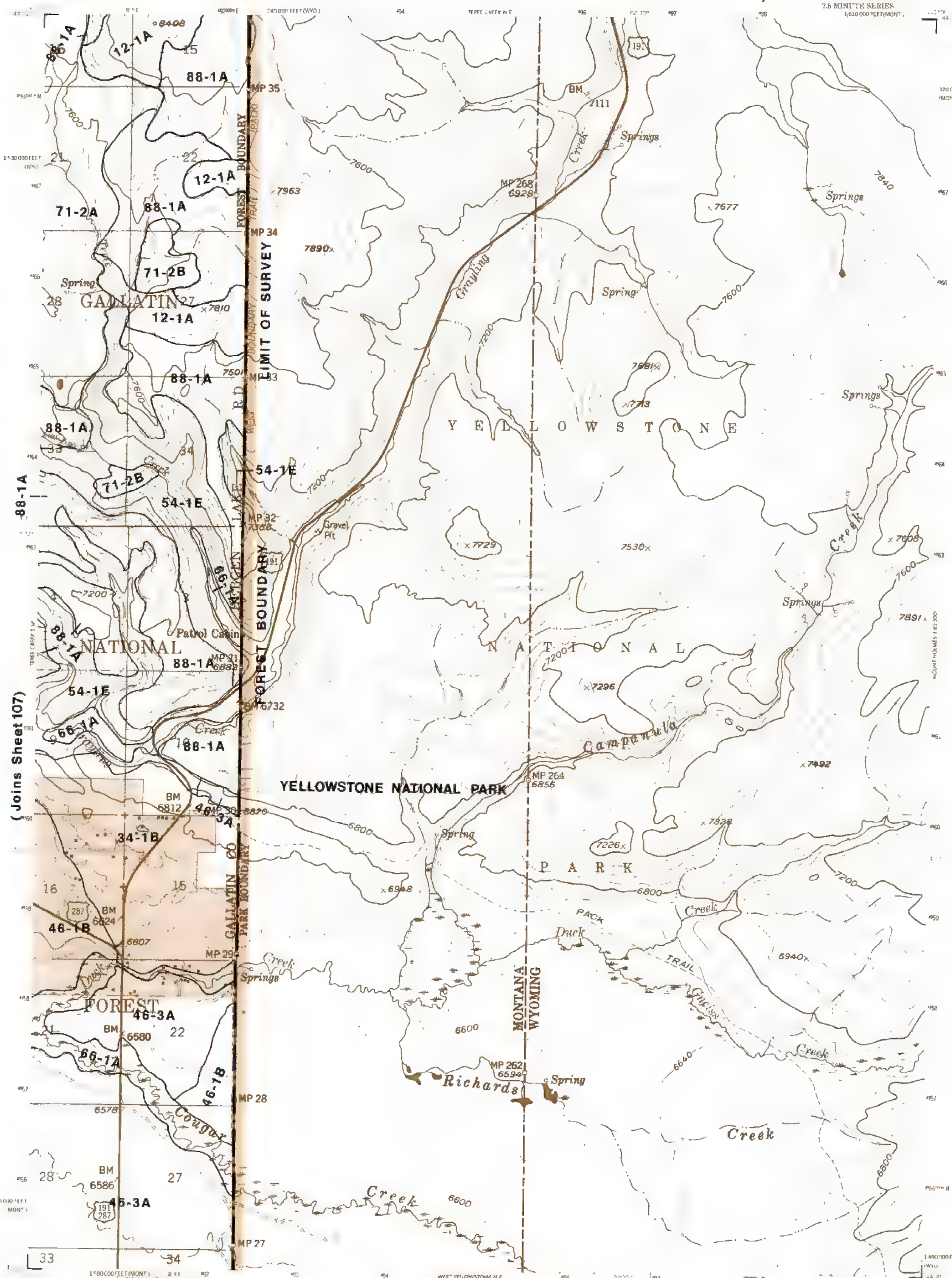
TEPEE CREEK S.W., MONTANA
N4545—W11107.5/7.5
1958

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 108
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

TEPEE CREEK S.E. QUADRANGLE
MONTANA–WYOMING
7.5 MINUTE SERIES

(Joins Sheet 104)



(Joins Sheet 107)

(Joins Sheet 112)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and by the Geological Survey 1958 Aerial photographs taken 1947 and 1954. Field checked 1958

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone Wyoming coordinate system west zone
1000 meter Universal Transverse Mercator grid ticks, zone 12 shown in blue

This map portrays ground conditions prior to the earthquake of August 17 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
DOTTED LINES REPRESENT 40 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
568 Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

TEPEE CREEK S.E., MONT-WYO.
N4445—W11100/7.5
1958

SHEET NUMBER 109
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

(Joins Sheet 105)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

TARGHEE PEAK QUADRANGLE
IDAHO–MONTANA

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the U. S. Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1959 and 1962. Field check 1964
Polyconic projection. 1927 North American datum
10,000-foot grid based on Idaho coordinate system, east zone and Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region
Photo transfer completed by the Regional Office, Missoula, Montana, from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

TARGHEE PEAK, IDAHO–MONT
1964

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

SHEET NUMBER 110
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

TARGHEE PASS QUADRANGLE
IDAHO MONTANA
7.5 MINUTE SERIES

(Joins Sheet 106)

(Joins Sheet 111)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey

Topography by photogrammetric methods from aerial photographs taken 1959 and 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000 foot grids based on Idaho coordinate system east zone and Montana coordinate system south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

TARGHEE PASS, IDAHO -MONT
N4437.5 W11115/7.5

1964

SHEET NUMBER 111
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

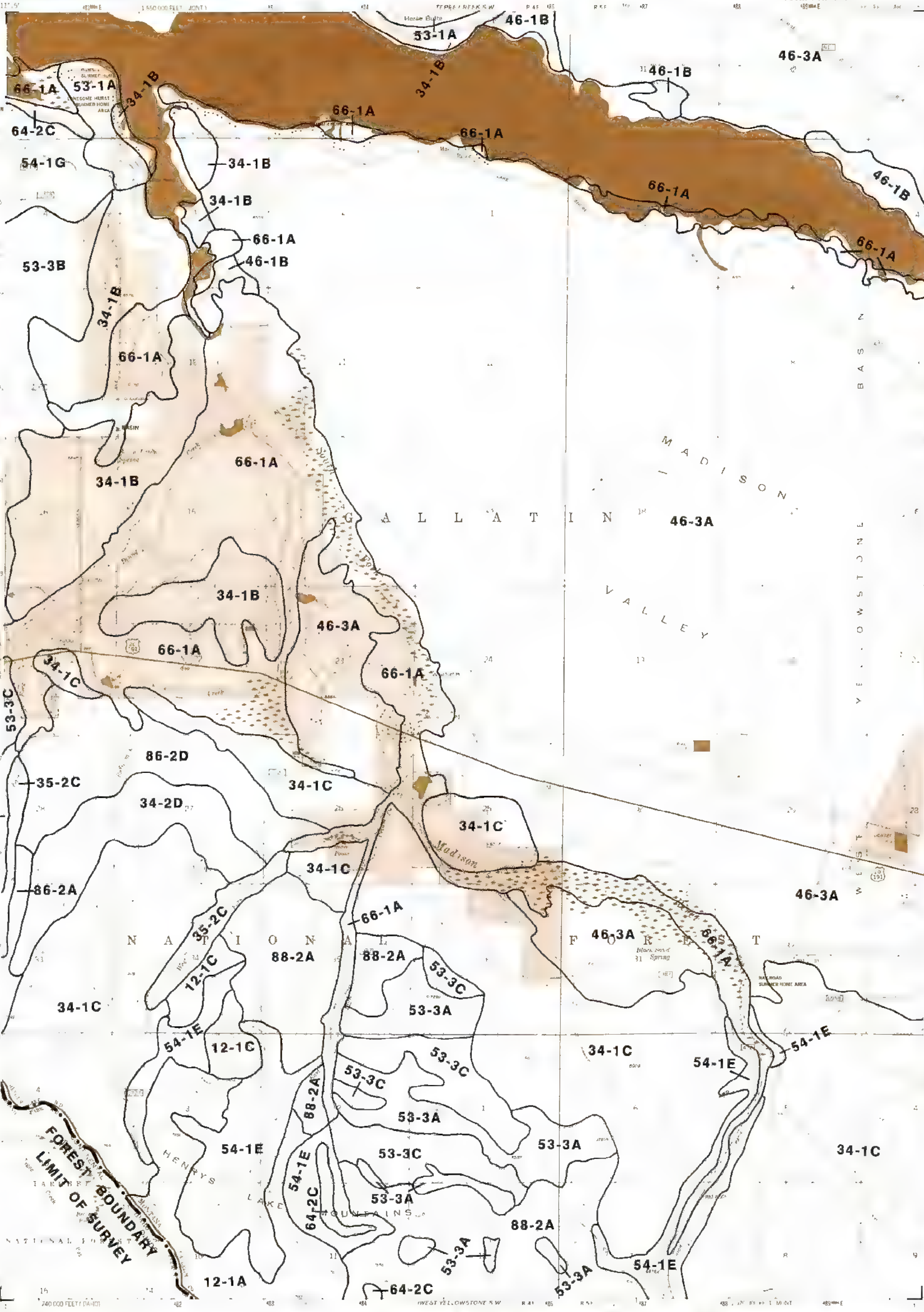
WEST YELLOWSTONE N.W. QUADRANGLE
MONTANA–IDAHO
7.5 MINUTE SERIES

(Joins Sheet 107)

(Joins Sheet 110)

(Joins Sheet 112)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 113)

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and the Geological Survey 1958 Aerial photographs taken 1947, 1953, and 1954 Field check 1958

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone Wyo. coordinate system, west zone, and Idaho coordinate system, east zone 1000 meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17, 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND

Primary Highway		Interstate	
Secondary Highway		U.S. Highway	
Light Duty Road		State Highway	
Primitive Road		County Highway	
Trail		Forest Road	
	568	Forest Trail	

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

WEST YELLOWSTONE N.W.,
MONT.-WYO.
N4437.5–W11107.5/7.5

SHEET NUMBER 112
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 108)

WEST YELLOWSTONE N.E. QUADRANGLE
MONTANA–WYOMING
7.5 MINUTE SERIES

(Joins Sheet 111)

(Joins Sheet 114)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and the Geological Survey 1958 Aerial photographs taken 1947, 1953, and 1954 Field check 1958

Polyconic projection. 1927 North American datum
10,000 foot grid based on Montana coordinate system, south zone, Wyo. coordinate system, west zone, and Idaho coordinate system, east zone 1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17, 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region.

Photo transfer completed by the Regional Office Missoula Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

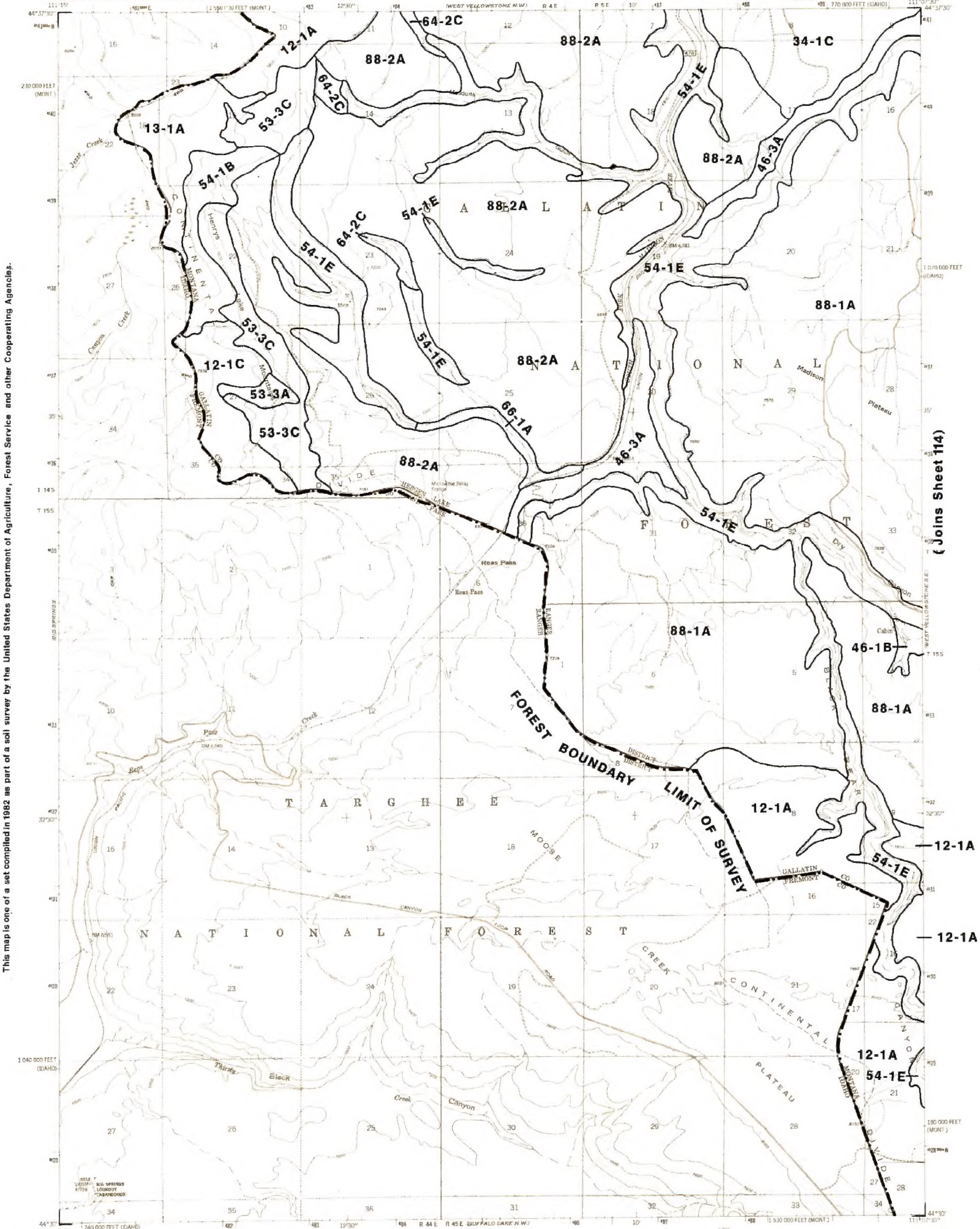
WEST YELLOWSTONE N.E.,
MONT.-WYO.
N4437.5—W11100/7.5
1958

SHEET NUMBER 113
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 111)

WEST YELLOWSTONE S.W. QUADRANGLE
MONTANA—IDAHO
7.5 MINUTE SERIES



(Joins Sheet 114)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and the Geological Survey 1958 Aerial photographs taken 1947, 1953, and 1954. Field check 1958

Polyconic projection. 1927 North American datum
10,000-foot grid based on Montana coordinate system, south zone, Wyo. coordinate system, west zone, and Idaho coordinate system, east zone 1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17, 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

WEST YELLOWSTONE S.W.,
MONT.-IDA.
N4430—W11107.5/7.5
1958

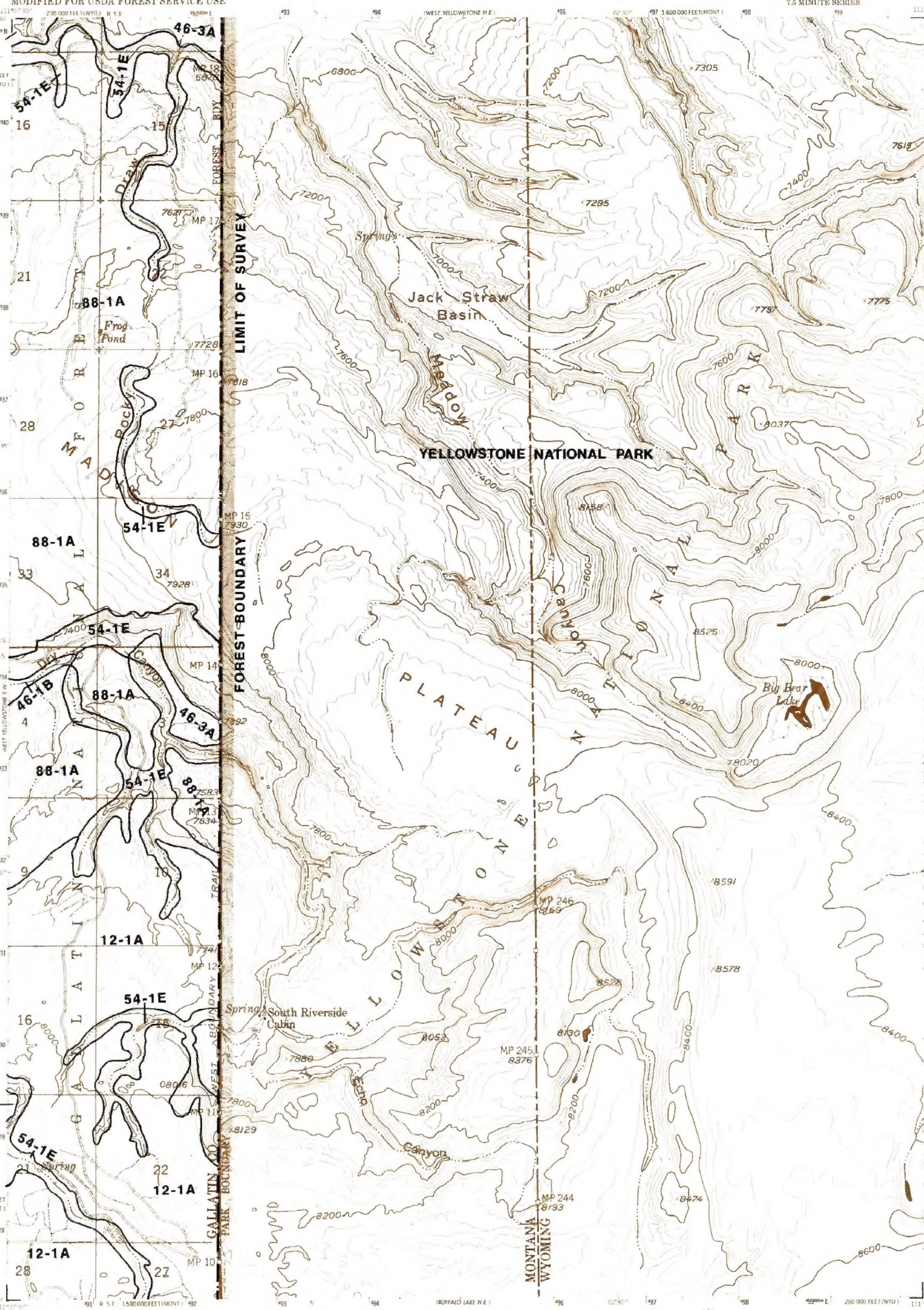
SHEET NUMBER 114
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

WEST YELLOWSTONE S.E. QUADRANGLE
MONTANA–IDAHO
7.5 MINUTE SERIES

(Joins Sheet 112)

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.



(Joins Sheet 116)

Base map prepared by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods for the Bureau of Reclamation 1948 and the Geological Survey 1958. Aerial photographs taken 1947, 1953, and 1954. Field check 1958

Polyconic projection. 1927 North American datum. 10,000-foot grid based on Montana coordinate system, south zone, Wyo. coordinate system, west zone, and Idaho coordinate system, east zone. 1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

This map portrays ground conditions prior to the earthquake of August 17, 1959

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail

Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

WEST YELLOWSTONE S.E.,
MONT.-WYO.
N4430—W11100/7.5

SHEET NUMBER 116
GALLATIN FOREST AREA
SOIL SURVEY, MONTANA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

(Joins Sheet 114)

BUFFALO LAKE N.E. QUADRANGLE
IDAHO-WYOMING-MONTANA
7.5 MINUTE SERIES

This map is one of a set compiled in 1982 as part of a soil survey by the United States Department of Agriculture, Forest Service and other Cooperating Agencies.

Base map prepared by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by Wild A—8 plotter
Aerial photographs taken 1953. Field check 1957
Polyconic projection. 1927 North American datum
10,000-foot grids based on Idaho coordinate system, east zone
Wyoming coordinate system, west zone, and Montana coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

INTERMEDIATE EDITION

Modifications to USGS base map by the Geometronics Service Center from 1979 correction guides furnished by the Northern Region

Photo transfer completed by the Regional Office Missoula, Montana from aerial photographs taken 1972 and 1975

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Wilderness Boundary
National Forest Boundary
Alienated Land within the National Forest Boundary

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Unreliable
Unsurveyed, BLM Protraction

LEGEND
Primary Highway
Secondary Highway
Light Duty Road
Primitive Road
Trail
Interstate
U.S. Highway
State Highway
County Highway
Forest Road
Forest Trail

GALLATIN NATIONAL FOREST
QUADRANGLE LOCATION DIAGRAM

BUFFALO LAKE N.E.,
IDAHO-WYO.-MONT.
N4422.5—W11100/7.5